Proposed Plan **September 2015**
Matthiessen and Hegeler Zinc Company Site
LaSalle, Illinois

INTRODUCTION

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The purpose of this Proposed Plan is to give background information about the Matthiessen and Hegeler Zinc Company Site (the M&H Site or the Site), describe the various cleanup alternatives the Agency considered, and identify EPA's preferred cleanup alternative. EPA will be accepting comments for 30 days from the issuance of this Proposed Plan. EPA encourages interested members of the public to attend and participate in a public meeting at the LaSalle Peru Township High School on October 20, 2015 at 7 pm and to comment on this Proposed Plan.

To clean up contamination at the M&H Site, EPA is proposing a remedy that includes the following major components: 1) excavating contaminated soil, including affected soil at most areas of the Site property and at impacted residential properties in the neighboring community; 2) construction of a disposal area within the main industrial property for consolidation of excavated material and capping the excavated and consolidated material with a soil cover system; 3) sloping, benching, and capping the large slag pile on Carus Corporation's (Carus) property with a soil cover system; 4) placing a cap in areas of the Carus plant; and 5) implementing and maintaining institutional controls (ICs) to restrict exposures and protect remedy components. The proposed remedy will be protective of human health and the environment, will meet applicable and/or relevant and appropriate requirements (ARARs), will be cost-effective, and will be effective in the long term.

This Proposed Plan identifies the preferred alternative for cleaning up the contaminated soil at the M&H Site and surrounding residential areas and presents the rationale for this preference. In addition, this Proposed Plan summarizes other cleanup alternatives evaluated for use at the Site. This document is issued by EPA, the lead agency for Site activities. EPA, in consultation with the Illinois Environmental Protection Agency (Illinois EPA), the support agency, will select a final remedy for the M&H Site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with Illinois EPA, may modify the preferred alternative or select another response action presented in this Proposed Plan based on new information or public comments. EPA encourages the public to review and comment on all of the alternatives presented in this Proposed Plan. Depending on information or comments EPA receives during the public comment period, the final cleanup plan may differ from this Proposed Plan.

This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) Reports and other documents contained in the Administrative Record file for the M&H Site. EPA and Illinois EPA encourage the public to review these documents to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted at the Site to date.

The public is encouraged to review the supporting documents for the M&H Site at any of the following locations:

LaSalle Public Library
305 Marquette Street
LaSalle, Illinois 61301
(815) 223-2341
Call for Hours

EPA Region 5 Records Center
77 W. Jackson Blvd. (SRC-7J)
Chicago, Illinois 60604
(312) 353-1063
Mon-Fri - 8 am to 4 pm
Call for appointment

Following EPA's review of the public comments, EPA will announce its final cleanup plan in a document called a Record of Decision (ROD). EPA will respond in writing to all significant comments in a Responsiveness Summary which will be part of the ROD. EPA will provide notice of its issuance of the ROD in local newspapers and will place a copy of the ROD in the local information repositories.

SITE BACKGROUND

The M&H Site property is located in the City of LaSalle, Illinois (population 9,646) (see Figure 1). The Site occupies approximately 227 acres and houses an inactive zinc smelting and rolling facility as well as an active chemical manufacturing plant, owned and operated by Carus. The Little Vermilion River (LVR) flows south along the eastern edge of the Site and eventually joins the Illinois River. Nearly 5,000 private residences are located on the west, south, and north sides of the Site. Northeast of the Site is farmland, and across the LVR is a limestone quarry. The City of LaSalle obtains all of its drinking water from a cluster of four active wells located three-quarters of a mile south of the M&H Site, with the nearest municipal well approximately 3,700 feet south of the Site. A wetland is located approximately two miles upstream of the Site on the LVR. Also, the Lake DePue State Fish and Wildlife Area and the Spring Lake Heron Colony, which provides breeding habitat for the state-endangered great egret, are located about 15 miles downstream of the Site.

The boundaries of the Site's two operable units (OU) are depicted on Figure 2. OU1 includes the Carus property (the Carus facility) located within the southern portion of the Site and a portion of the LVR. The entirety of a large slag pile located primarily on the Carus facility is also considered part of OU1, even though the slag was generated by smelting operations at OU2. A small portion of the slag pile crosses the OU2 property boundary. OU2 includes the formerly-occupied rolling mill area and all other associated buildings and land related to the former smelting operations. The large residential area surrounding the M&H Site is also part of OU2.

Industrial operations at the M&H Site began in 1858, and some operations continue through the present day. More details regarding the industrial operations at each OU are provided below.

OU1 History

Carus operates an active business on the OU1 property. The Carus facility manufactures potassium permanganate and other specialty chemicals. Manufacturing and business operations for Carus are independent from those formerly conducted by the Matthiessen and Hegeler Zinc Company on the OU2 portion of the Site.

Carus began operations in 1915 manufacturing potassium permanganate products used for water purification and wastewater treatment, and its operations continue through the present time. Carus added other products to its manufacturing operations over time, including:

- Phosphate corrosion inhibitors
- Manganese dioxide
- Sodium permanganate
- 2,3-pyridine dicarboxylic acid
- Manganese-based catalysts
- Hydroquinone
- Manganese sulfate
- Cesium compounds

During the period from 1858 to 1961, sinter and slag from the smelting operations at OU2 were placed at various locations on what is now designated as OU1. Sinter and slag were placed primarily in an upland area between the Carus facility and the LVR. The resultant slag pile covers an area of approximately 17.7 acres and stands approximately 80 to 90 feet tall. Carus did not own the slag pile area during the zinc smelting operational period at OU2, but purchased that property after the majority of slag had been placed there.

OU2 History

The Matthiessen and Hegeler Zinc Company operated a zinc smelter at the OU2 portion of the Site from 1858 until 1961. The company added a rolling mill to its operations in 1866 to produce zinc sheets. This process included a furnace that used producer gas as fuel. Any sulfur dioxide generated was recovered and converted into sulfuric acid and stored in on-site tanks. For a few years during the early 1950s, an ammonium sulfate fertilizer plant operated at OU2. Coal mining also occurred on OU2 until 1937, and two mining shafts (one vertical and one horizontal) still remain at the Site. Zinc smelting ceased in 1961, and sulfuric acid manufacturing halted in 1968. The Matthiessen and Hegeler Zinc Company declared bankruptcy in 1968, and only basic rolling mill operations took place at OU2 from 1968 until 1978. In 1980, Fred and Cynthia Carus purchased the 12-acre rolling mill tract of land which became the LaSalle Rolling Mill, Inc.

The LaSalle Rolling Mill, Inc. generated penny blanks for the U.S. Mint until 2000, when the company ceased operations and declared bankruptcy. In 2003, EPA conducted an emergency removal action at the LaSalle Rolling Mill to address cyanide contamination, an old plating line, and various other chemicals and storage tanks that remained after the rolling mill closed. From 2005 through 2008, Fred Carus leased the former rolling mill building and an adjacent building to a company housing backerboard.

Metals and cyanide were used at OU2 during past operations. The operations included, among other things, converting raw zinc ore containing zinc sulfide to zinc oxide and subsequent smelting of the zinc oxide sinter to produce metallic zinc. Sulfur from the first phase of the process was recovered and converted into sulfuric acid. Much of the equipment associated with sulfuric acid production either was constructed of lead or was lead-lined. An on-site lead burner was used to manufacture and repair lead components. Other metals were also present in the zinc ore as impurities, including lead and cadmium.

A narrow-gauge, on-site industrial railroad was used to move the ore about the Site, with locomotives that ran on gasoline. The machinery, engine oils, and underground storage tanks containing gasoline all contributed volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) to the Site.

During at least part of the time that the Matthiessen and Hegeler Zinc Company operated at OU2, it generated its own electrical power for use in the zinc refining plant and coal mine. Polychlorinated bipenyls (PCBs) were commonly used in electrical transformers manufactured between 1929 and 1977. Additional potential sources of PCBs include lubricating and hydraulic oils that may have been used in on-site equipment.

Pesticides may have also been used during Site operations. It was a common practice in the mid-1900s to spray herbicides to control vegetation near railroads, three of which were located on the Site, mainly on OU2: the Illinois Central Railroad on the east, the LaSalle and Bureau County Railroad on the west, and the on-site narrow-gauge industrial railroad previously mentioned.

Asbestos was used as a building material (transite walls and roofs, as thermal insulation and fire proofing) in many of the 150 buildings found on OU2. In addition, steam pipes that traversed OU2 were wrapped in asbestos-type insulation.

Site Investigations and Cleanup Actions

In 1991, Illinois EPA performed a Preliminary Assessment and Screening Site Inspection of the Carus facility (OU1). Subsequently, Illinois EPA conducted another CERCLA Preliminary Assessment in 1993 and a CERCLA Integrated Assessment in 1994 to evaluate the contaminant sources at the M&H Site. From 1992 through 1994, Carus's contractor, Geosyntec, conducted several Site investigations at the Carus facility and the slag pile at OU1.

EPA proposed the M&H Site to the National Priorities List (NPL) on June 14, 2001, and finalized the Site on the NPL on September 29, 2003. Two primary on-site sources were used to score the Site for the NPL: (1) the large slag and sinter pile located at OU1; and (2) a shallow waste pile of slag and sinter heterogeneously deposited throughout the former smelter property at OU2.

On September 3, 2003, EPA and Fred Carus entered into an Administrative Order on Consent (AOC) for a removal action at OU2. The AOC required that eight areas of concern at the rolling mill be addressed with regard to storage tanks, plating lines, residual product and waste material, and asbestos. Fred Carus completed the majority of the removal action work at the rolling mill in 2003-2004, but the completion report was not submitted until June 2008 due to some issues with disposal of some of the contaminated materials.

In September 2006, EPA entered into an Administrative Settlement and Agreement on Order of Consent (ASAOC) with Carus, one of the potentially responsible parties at the Site. Under the ASAOC, the M&H Site was divided into two OUs, with Carus conducting the RI/FS study work at OU1 and EPA conducting the RI/FS work at OU2. The ASAOC required a single, comprehensive RI Report, Risk Assessment Report, and FS Report for the Site. The owners of OU2 decided not to participate in the RI/FS process. The RI work at the Site began in 2007.

For OU1, Carus sampled soil, slag, groundwater, surface water, sediment, and air during the period 2007-2009. For the investigations conducted at OU2, EPA sampled soils, building materials, debris piles, groundwater, surface water, and air during the period 2007-2010.

In response to asbestos being encountered during the RI around the rolling mill (OU2), in 2008 EPA tasked the Superfund Technical Assessment and Response Team (START) contractor to conduct another removal assessment at the M&H Site. The assessment activities included investigating unknown chemicals in a former laboratory building, conducting asbestos sampling at multiple buildings, and investigating unknown oil in sewer drains. In 2009, EPA tasked the START contractor to conduct removal activities at OU2 as outlined in the 2008 Removal Action Assessment Report, including asbestos removal from multiple buildings and demolition of a former chemical laboratory building. EPA's removal work was completed during 2009.

SITE CHARACTERISTICS

Hydrology, Geology, and Hydrogeology

The M&H Site has two different water-bearing zones (WBZs) – one shallow and one deeper. Regionally, aquifers are represented by sands and gravels within surficial glacial deposits and the underlying permeable sandstone and limestone bedrock formations. The City of LaSalle has a municipal well field approximately 0.75 mile south of the M&H Site that derives water from the glacial sands and gravels at 60 to 70 feet below ground surface (ft bgs). The City of Peru has a municipal well field approximately 2 miles southwest of the Site that derives water from bedrock formations located at more than 2,000 ft bgs. The groundwater investigation at the M&H Site focused on a much shallower water-bearing zone (at 20 to 50 ft bgs) and not on the regional aquifers used by these nearby municipalities. Site-related activities have not impacted the deep bedrock formation since the shallow groundwater system does not connect with the deeper aquifer.

The shallow water-bearing zone at the Site, denoted as WBZ1, consists of unconsolidated materials and is typically found to a depth of 20 ft bgs. Shallow groundwater at a number of WBZ1 wells was encountered within 10 feet of the ground surface. These unconsolidated materials consist of Quaternary-aged sands, gravels, silts, and clays (also known as glacial till), and artificial fill materials (slag, sinter, brick, reworked soils, and Site geologic materials). WBZ1 is unconsolidated and discontinuous, and is composed of separate and irregular lenses of water in the subsurface. Groundwater in WBZ1 generally flows to the east and southeast, toward the LVR.

WBZ2 consists of the underlying Pennsylvanian-aged shale bedrock and the top (typically 0 to 3 feet) of Pennsylvanian-aged limestone bedrock. Like WBZ1, the groundwater in WBZ2 generally flows to the east and southeast, toward the LVR. The weathered and fractured upper portions of the bedrock are likely more permeable than the intact rock, with the intact lower permeability bedrock acting as a base to the water table hydrogeologic system. Deeper, more intact portions of the Pennsylvanian system are judged to effectively isolate the surface groundwater system from deeper water supply aquifers. The hydraulic conductivity data indicate there are no significant, widely-distributed, low-permeability horizons above the bedrock surface. This absence of aquitards suggests the two WBZs at the Site may be acting as a single interconnected system.

The RI identified contaminants of interest based on comparisons to potable water screening values, including those for Class I - Potable Resource Groundwater as defined by Illinois EPA regulations, because groundwater at the Site had not yet been classified by the State. The Illinois EPA subsequently classified the groundwater within WBZ1 and WBZ2 as Class II - General

Resource Groundwater because the majority of groundwater wells in WBZ1 and WBZ2 do not meet the criteria for Class I - Potable Resource Groundwater (e.g., they have low hydraulic conductivity, shallow depth to water, etc.) as defined in 35 Illinois Administrative Code (IAC) 620.210.

Class II - General Resource Groundwater is defined in 35 IAC 620.220 as groundwater that does not meet the criteria of the other three classes and that is "capable of agricultural, industrial, recreational, or other beneficial uses." The City of LaSalle has an existing ordinance (Ordinance Number 1755, dated January 16, 2002) prohibiting the drilling of water supply wells throughout the city. The city ordinance covers the M&H Site and adjacent areas. In a January 2002 Memorandum of Understanding (MOU), Illinois EPA accepted this ordinance as an IC for protection from risks from impacted groundwater.

The surface water features at the M&H Site are not considered jurisdictional wetlands because they are isolated depressions with no connection to a jurisdictional water body. Additionally, hydric soil characteristics are absent at OU2 surface water locations, and none of the mapped soils are classified as hydric soils.

Investigation Findings

For purposes of the risk assessment and the FS, the two OUs at the M&H Site were further subdivided into different exposure areas (EAs) in order to evaluate the Site in terms of risk.

Operable Unit 1

OU1 was subdivided into three different EAs for risk assessment purposes, as shown in Figure 3:

- Carus Plant Area
- Slag Pile Area
- Little Vermilion River

At OU1, the primary contaminants of concern (COCs) found in surface and subsurface soil samples were metals and, to a lesser extent, SVOCs and PCBs. The number of exceedances for SVOCs and PCBs and their horizontal and vertical distribution were less than for metals. In addition, several, though not all, of the SVOC and PCB exceedances were from samples collected in the early 1990s during the state's Preliminary Assessment. At the Carus Plant Area, analytical results generally indicated that surface soils located 0 to 2 ft bgs contained higher contaminant concentrations and a greater extent of contamination when compared to subsurface samples (greater than 2 ft bgs). COCs at the Carus Plant Area were limited to metals, SVOCs, and PCBs (a single pre-1994 sample contained PCBs) in surface soils, with only metals detected above the screening levels in subsurface soils. At the Slag Pile Area, both metals and SVOCs were present above screening values in both surface and subsurface samples.

A select number of soil and slag samples from OU1 were analyzed for toxicity characteristic leaching procedure (TCLP) metals. Some of these samples' analyte concentrations exceeded the maximum concentration of contaminants for the toxicity characteristic regulatory levels, which identifies those soil samples as being characteristically hazardous due to toxicity.

The following is a subset of the most relevant contaminants and their associated maximum concentrations within various media at each OU1 EA.

Carus Plant Area

- The maximum arsenic concentration in shallow soil was 33.6 milligrams per kilogram (mg/kg)
- The maximum arsenic concentration in deep soil was 50.5 mg/kg
- The maximum manganese concentration in shallow soil was 118,000 mg/kg
- The maximum manganese concentration in deep soil was 9,380 mg/kg
- The maximum lead concentration in shallow soil was 3,660 mg/kg
- The maximum lead concentration in deep soil was 510 mg/kg
- The maximum benzo(a)pyrene concentration in shallow soil was 1,000 micrograms per kilogram (µg/kg)

Slag Pile Area

- The maximum arsenic concentration in shallow soil was 251 mg/kg
- The maximum arsenic concentration in deep soil was 117 mg/kg
- The maximum lead concentration in shallow soil was 38,700 mg/kg
- The maximum lead concentration in deep soil was 3,850 mg/kg
- The maximum manganese concentration in shallow soil was 123,000 mg/kg
- The maximum manganese concentration in deep soil was 40,600 mg/kg

Little Vermilion River

- The maximum mercury concentration in sediment was 0.53 mg/kg
- The maximum zinc concentration in surface water was 69,200 micrograms per liter (µg/L)
- The maximum lead concentration in surface water was 91.0 µg/kg

Operable Unit 2

OU2 was subdivided into seven different EAs for risk assessment purposes, as shown in Figure 4:

- EA1 – Main Industrial Area (also known as the "MIA" or "Main Plant Area" on some figures and tables)
- EA2 – North Area (also known as Wooded Area - North)
- EA3 – Wooded Area - Northeast
- EA4 – Building 100 Area
- EA5 – Rolling Mill
- EA6 – Off-Site Residential Area
- EA7 – Off-Site Mixed Use Area

In general, analytical results indicated that surface soil at OU2 contains higher contaminant concentrations and a greater extent of contamination than subsurface soil.

As at OU1, a select number of soil samples from OU2 were analyzed for TCLP metals. Some of these samples' analyte concentrations exceeded the maximum concentration of contaminants for the toxicity characteristic regulatory levels, which identifies those soil samples as being characteristically hazardous due to toxicity.

A PCB hot spot was found in surface and subsurface soil around Building 100. This was the only area at the Site where elevated concentrations of PCBs were found in the soil at depth during the RI.

A trichloroethylene (TCE) hot spot was found in an area near the corner of the rolling mill in surface soil, subsurface soil, and groundwater. The potential for vapor intrusion was evaluated in the risk assessment to determine the potential for unacceptable risks to human health from vapor intrusion into the rolling mill building. Based on this assessment, it was determined that additional data needed to be gathered in order to determine if there was any risk associated with vapor intrusion within the rolling mill building. This data will be collected during the remedial design phase. If this data shows that vapor intrusion presents a risk, the ROD may be amended to include a remedy for TCE and vapor intrusion within the rolling mill.

Since asbestos was detected in surface soil at OU2, activity-based sampling (ABS) and releasable asbestos field sampler (RAFS) investigations were conducted in 2009 to assess the risk of airborne asbestos to workers and nearby residents. Air samples were collected from four outdoor locations where previously collected soil samples had analytical asbestos results near the 1 percent concentration threshold, in accordance with EPA asbestos guidance. Areas with soil asbestos concentrations much greater than the 1 percent threshold and where human exposure risks are expected and assumed to be highest were not proposed for ABS or RAFS sampling. None of the air sample results tested positive for asbestos above the detection limit, which ranged from 0.005 to 0.006 fibers per cubic centimeter.

The following is a subset of the most relevant contaminants and their associated maximum concentrations within various media at each OU2 EA.

Main Industrial Area – Soils

- The maximum arsenic concentration in surface soil was 810 mg/kg
- The maximum arsenic concentration in subsurface soil was 528 mg/kg
- The maximum cadmium concentration in surface soil was 1,020 mg/kg
- The maximum cadmium concentration in subsurface soil was 770 mg/kg
- The maximum lead concentration in surface soil was 209,000 mg/kg
- The maximum lead concentration in subsurface soil was 62,600 mg/kg
- The maximum mercury concentration in surface soil was 154 mg/kg
- The maximum mercury concentration in subsurface soil was 145 mg/kg
- The maximum zinc concentration in surface soil was 218,000 mg/kg
- The maximum zinc concentration in subsurface soil was 98,100 mg/kg
- The maximum benzo(a)anthracene concentration in surface soil was 71,000 μg/kg
- The maximum benzo(a)anthracene concentration in subsurface soil was 29,000 μg/kg

North Area – Soils

- The maximum arsenic concentration in surface soil was 129 mg/kg
- The maximum arsenic concentration in subsurface soil was 61.4 mg/kg

Wooded Area – Northeast – Soils

- The maximum lead concentration in surface soil was 212 mg/kg
- The maximum zinc concentration in subsurface soil was 596 mg/kg

Building 100 Area - Soils

- The maximum arsenic concentration in surface soil was 217 mg/kg
- The maximum arsenic concentration in subsurface soil was 257 mg/kg
- The maximum lead concentration in surface soil was 14,500 mg/kg
- The maximum lead concentration in subsurface soil was 13,200 mg/kg
- The maximum Aroclor-1260 PCB concentration in surface soil was 210,000 μg/kg
- The maximum Aroclor-1260 PCB concentration in subsurface soil was 39,000 μg/kg

Rolling Mill – Soils

- The maximum arsenic concentration in surface soil was 66 mg/kg
- The maximum arsenic concentration in subsurface soil was 93.7 mg/kg
- The maximum lead concentration in surface soil was 9,410 mg/kg
- The maximum lead concentration in subsurface soil was 10,700 mg/kg
- The maximum TCE concentration in surface soil was 210 μg/kg
- The maximum TCE concentration in subsurface soil was 120,000 μg/kg

Off-Site Residential Area – Soils

- The maximum arsenic concentration in surface soil was 51.2 mg/kg
- The maximum lead concentration in surface soil was 3,220 mg/kg
- The maximum cadmium concentration in surface soil was 120 mg/kg

Off-Site Mixed Use Area – Soils

- The maximum lead concentration in surface soil was 145 mg/kg
- The maximum zinc concentration in subsurface soil was 1,120 mg/kg

Site-wide Groundwater

Since different parties were conducting the OU1 and OU2 RI work, the groundwater at OU1 and OU2 was investigated separately. The maximum contaminant concentrations in groundwater at each OU are listed below.

Groundwater Beneath OU1

- The maximum arsenic concentration in groundwater beneath the Carus Plant Area was 21.1 μg/L
- The maximum arsenic concentration in groundwater beneath the Slag Pile Area was 57.2 μg/L

Groundwater Beneath OU2

- The maximum TCE concentration in groundwater (located near the rolling mill) was 230 μg/L
- The maximum naphthalene concentration in groundwater (located near Building 100) was 37 μg/L
- The maximum arsenic concentration in groundwater was 24.2 μg/L

For OU1, the primary COCs found in groundwater samples were metals and to a limited extent, VOCs and SVOCs. The RI identified metals, two VOCs (in a single sample), and one SVOC (also in a single sample) as COCs in groundwater samples collected from the Carus Plant Area; COCs in groundwater samples collected from the Slag Pile Area were metals only.

Regarding the groundwater at OU2, samples from WBZ1 wells in OU2 contained higher concentrations of contaminants (primarily metals) than samples from WBZ2 wells. WBZ1 wells are screened in unconsolidated overburden materials, primarily at shallow depths. Therefore, WBZ1 wells are closer to surface soil contamination and surface discharges. The highest metals concentrations were detected in groundwater samples from WBZ1 wells in the OU2 Main Industrial Area. Polycyclic aromatic hydrocarbons (PAHs) were detected near former aboveground storage tanks, northeast of Building 100. TCE was detected in OU2 groundwater near the rolling mill building along the southern boundary of OU2. For both PAHs and VOCs, detections were localized.

Principal Threat Waste

There are no wastes at the Site that would be considered highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health and the environment should exposure occur. The contamination at the Site is considered low-level threat waste.

Conceptual Site Model

The conceptual Site models (CSMs) for OU1 and OU2 are presented in Figures 5 and 6, respectively. These CSMs illustrate the fate and transport of contaminants in each OU through various media and the potential exposure to receptors.

SCOPE AND ROLE OF THE ACTION

The response action in this Proposed Plan addresses both OUs at the Site and is expected to be the final action for the M&H Site. The Site was split into two OUs during the RI/FS because there were different parties performing the RI/FS work at each OU; any sequencing of the remedial action work is not anticipated to be carried out based on the OU designations. As noted earlier in this Proposed Plan, two prior removal actions have been conducted at OU2: one under an AOC in 2003-2008 to address concerns at the rolling mill, and a second by EPA in 2009 to address asbestos concerns near the rolling mill.

The proposed response action does not address Site groundwater because EPA believes that groundwater does not warrant a CERCLA response action now or in the future (as discussed later in this Proposed Plan).

The proposed response action will meet all of the remedial action objectives (RAOs) that were developed for the Site. The RAOs are described later in this Proposed Plan. The proposed response action addresses low-level threat wastes at both OUs; there are no principal threat wastes at the Site.

SUMMARY OF SITE RISKS

A baseline risk assessment estimates what risks a Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by a remedial action. This section of the Proposed Plan summarizes the results of the risk assessment that was conducted for the M&H Site. The risk assessment included the following elements:

- OU1 baseline human health risk assessment (HHRA)
- OU1 screening level ecological risk assessment (SLERA)
- OU1 baseline ecological risk assessment (BERA)

- OU2 HHRA
- OU2 SLERA
- OU2 BERA

Prior to conducting the risk assessment, Geosyntec and SulTRAC (consultants for Carus [OU1] and EPA [OU2], respectively) jointly prepared and submitted a technical approach Consensus Document describing risk assessment methodologies for the HHRAs, SLERAs, and BERAs. The Consensus Document underwent extensive review and comment prior to being approved by EPA and the State. Use of the Consensus Document helped ensure that risk assessment methodologies and results for OUs 1 and 2 would be comparable. While OU-specific risks and hazards were prepared and discussed, both the human health and ecological risk assessments identified and evaluated potential exposure of receptors to chemical contamination at both OUs.

Human Health Risks

The risk assessment evaluated both cancer risks and non-cancer hazards. The likelihood of any kind of cancer resulting from exposure to carcinogens at a Superfund site is generally expressed as an upper bound incremental probability, such as a "1 in 10,000 chance" (expressed in scientific notation as 1E-04). In other words, for every 10,000 people exposed to the Site contaminants under reasonable maximum exposure conditions, one extra cancer may occur as a result of Site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risk of cancer individuals face from other causes such as smoking or too much sun. The risk of cancer from other causes has been estimated to be as high as one in three. The potential for non-cancer health effects is evaluated by comparing an exposure level over a specified time period (such as a lifetime) with a "reference dose" derived for a similar exposure period. A reference dose represents a level that is not expected to cause any harmful effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ < 1 indicates that the dose from an individual contaminant is less than the reference dose, so non-cancer health effects are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs that affect the same target organ (such as the liver). An HI < 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, non-cancer health effects from all contaminants are unlikely. An HI > 1 indicates that Site-related exposures may present a risk to human health. EPA's acceptable risk range is defined as a cancer risk range of 1E-06 to 1E-04 and an HI < 1. Generally, remedial action at a Site is warranted if cancer risks exceed 1E-04 and/or if non-cancer hazards exceed an HI of 1.

In the summary information presented below, the OU-specific EAs are identified first. Second, the joint and OU-specific exposed populations (receptors) are identified. Third, non-standard or unique receptors, exposure assumptions, and exposure scenarios are discussed. Finally, OU-specific risks and hazards under both current and future land use conditions are summarized. Much more detail regarding the HHRA is available in the Administrative Record file for the Site.

Exposure Areas

As noted earlier, OU1 and OU2 were both divided into multiple EAs to evaluate current and potential future exposures, as follows:

OU1 Exposure Areas (see Figure 3)

- Carus Plant Area
- Slag Pile Area
- LVR

OU2 Exposure Areas (see Figure 4)

- Main Industrial Area (EA1)
- North Area (EA2) (also known as Wooded Area - North)
- Wooded Area - Northeast (EA3)
- Building 100 Hotspot (EA4)
- Rolling Mill Area (EA5)
- Off-Site Residential Area (EA6)
- Off-Site Mixed Use Area (EA7)

Exposed Populations (Receptors)

As part of the Consensus Document, a series of joint (i.e., evaluated at both OUs) human receptors, as well as a limited number of OU-specific human receptors, were identified. The joint and OU-specific receptors are identified below.

Joint Receptors

- Commercial/industrial workers (assumed to be adults; under current conditions, these receptors are Carus employees at OU1)
- Utility workers (assumed to be adults)
- Construction workers (assumed to be adults)
- Trespassers (both adolescents and adults were evaluated)
- Recreationalists (children, adolescents, and adults were evaluated)
- Residents (child and aggregate [time-weighted] residents were evaluated). At OU1, a residential exposure scenario was termed "hypothetical" because replacement of the current operating Carus Chemical operations by a residential scenario is very unlikely. Within OU2, EA6 is a current residential area, and at EA2, potential residential development under future land use conditions was evaluated but later determined to be very unlikely

OU-Specific Receptors

OU-specific receptors were evaluated only at OU1 and include the following:

- Site-specific worker (OU1 workers exposed at the Slag Pile Area; non-traditional exposure)
- Recreational shoreline angler (both adolescent and adult anglers were evaluated)
- Fish consumer (child, adolescent, and adult fish consumers were evaluated)

<u>Non-standard or Unique Receptors, Exposure Assumptions, and Exposure Scenarios</u>

All joint and OU-specific receptors were evaluated, to the extent possible, using standard and approved federal and Illinois assumptions, based on *Risk Assessment Guidance for Superfund* (RAGS) and Illinois' "Tiered Approach to Corrective Action Objectives" (TACO)-related guidance documents and directives, respectively. For many receptors (including site-specific workers, trespassers, recreationalists, and recreational shoreline anglers), the primary non-standard exposure assumption was the exposure frequency – the number of days these receptors were assumed exposed each year. While non-standard, the receptor-specific exposure frequency assumptions used for these receptors were informed by assumptions regarding similar receptors at other EPA Region 5 sites, while incorporating site-specific conditions (for example, the unique situation of the very large slag pile inspected by the site-specific OU1 worker).

EPA considered a number of potential assumptions regarding the relative bioavailability (RBA) for lead and arsenic when evaluating potential exposure to those COCs in soil (including slag and sinter where present). The risk assessment discusses evidence of reduced bioavailability of arsenic in slag and sinter (unique to a former smelting operation). However, while this claim of reduced arsenic bioavailability is compelling in many regards, neither within the State of Illinois nor nationally, has agreement been reached concerning the level or application of RBA of arsenic in sinter and slag. For the final risk assessment report, an arsenic RBA of 0.8 was applied. However, in December 2012, EPA released guidance entitled "Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil," which recommended a default

RBA of 0.6 for arsenic in soil. The EPA-recommended default RBA values of 0.6 for arsenic and lead were ultimately used in developing site-specific preliminary remediation goals (PRGs).

During agency review of the FS, EPA decided to conduct site-specific bioavailability testing to compare the default RBA numbers that were used in calculating PRGs for both arsenic and lead to site-specific soil samples from the Off-Site Residential Area. In 2014, individual properties were selected for sampling based primarily on lead concentrations in soil. Ten residential properties and two alternate properties were selected for sample collection. Based on the sample results, the M&H site-specific lead RBA was calculated as 50.7 percent based on the mean of 9 property-specific values. An arsenic RBA was calculated for only four of the 10 total soil samples because only these four had useable arsenic results. As a result, the arsenic RBA was considered as the highest available result (36.9 percent). For both lead and arsenic, the calculated site-specific RBA value was less than the default EPA-recommended value. For arsenic, all of the sample-specific RBA results (27.3 - 36.9 percent) were less than the EPA-recommended default value of 60 percent. The majority of sample-specific lead RBA results also were less than the EPA-recommended value of 60 percent, while the maximum sample-specific lead RBA result (62.1 percent) was similar to the EPA-recommended default value. Ultimately, EPA decided to use the EPA-recommended default RBA value of 60 percent when calculating soil PRGs for both arsenic and lead for two primary reasons: (1) based on the small sample size, the calculated site-specific RBAs could theoretically underestimate the actual RBAs; and (2) given the uncertainty, use of the higher EPA-recommended default RBAs would result in more health-protective (lower) soil PRGs. Another factor that influenced EPA's decision to use the default RBA for lead was the knowledge that EPA headquarters is currently evaluating changes to EPA's lead policy, based partially on the Centers for Disease Control's updated recommendations on children's blood lead levels, and such changes could result in lower cleanup levels for lead in soil than under the current lead policy.

EPA also used site-specific risk assessment assumptions regarding exposure frequencies (EFs) and fractional uptakes (FIs). For the inhalation and dermal exposure pathways only, the EF was reduced from the default of 350 days per year to 275 days per year to account for frozen ground and/or snow cover conditions during winter, when limited or no exposure via dermal contact with soil or incidental inhalation of soil would occur. The FI for homegrown produce was reduced from 1.0 to 0.5 (the central tendency value) to reflect site-specific conditions, as the area surrounding the Site is highly agricultural and many residents ingest home-grown produce from their gardens and local markets.

OU-Specific Risks and Hazards

The various COCs for the M&H Site are included in Table 1 for the various media and exposure scenarios evaluated in the risk assessment. The results of the risk assessment for each OU are summarized below. As noted earlier, a variety of land uses and potential receptors were considered. The current and/or most likely future land uses and associated receptors are **bolded and underlined** in the information summarized below.

OU1

Carus Plant Area – soils

- Cancer risks within or below the acceptable risk range (1E-06 to 1E-04) for worker scenarios
- Non-cancer hazards > 1 for worker scenarios (1.3 to 20 for manganese and mercury)
- Lead concentrations > 800 mg/kg in 2 of 32 samples
- Land uses: **commercial/industrial** (active industrial facility)
- Receptors: **commercial/industrial worker**, utility worker, and construction worker
- Exposure route: ingestion, direct contact, inhalation

Slag Pile Area – soils

- Cancer risks within the acceptable risk range for all receptors evaluated
- Non-cancer hazards > 1 for worker scenarios (2.1 to 31 for manganese and lead)
- Lead concentrations > 800 mg/kg in about half of samples
- Land uses: **commercial/industrial**
- Receptors: **commercial/industrial worker, utility (e.g., maintenance) worker, construction worker,** and trespasser
- Exposure route: ingestion, direct contact, inhalation

LVR

- Sediment and surface water cancer risks within or below the acceptable risk range
- Sediment and surface water non-cancer hazards < 1
- Fish consumption cancer risks within or below the acceptable risk range
- Fish consumption non-cancer hazards > 1 (2 for mercury, based on maximum filet concentration and reasonable maximum exposure assumptions, but concentrations consistent with natural background)
- Land uses: **recreational**
- Human Receptors: **recreational anglers**, fish consumers
- Ecological Receptors: **macroinvertebrates, fish, riparian (shoreline) birds and mammals**
- Exposure route: ingestion, direct contact

OU2

Main Industrial Area – soils

- Cancer risks exceed 1E-04 for utility workers (2E-04)
- Cancer risks within the acceptable risk range for other worker scenarios
- Non-cancer hazards > 1 for all worker scenarios (5.9 to 240 for metals, TCE, and PCBs)
- Lead presents risk to all workers and child recreationalists
- Asbestos risk under non-intrusive scenarios to commercial/industrial worker only
- Land uses: **commercial/industrial** and recreational
- Receptors: **commercial/industrial worker, utility worker, construction worker**, trespasser, and recreationalist
- Exposure route: ingestion, direct contact, inhalation

North Area - soils

- Cancer risks within the acceptable risk range for all workers
- Non-cancer hazards > 1 for worker scenarios (1.6 for commercial/industrial, but < 1 and insignificant when segregated by target organs; 4.0 for future construction worker driven by incidental ingestion of zinc)
- Cancer risks and non-cancer hazards exceed the acceptable risk range for future residents, but a future residential scenario was later determined not to be realistic
- Lead presents risk to construction workers (and future residents as was initially evaluated in the FS)
- Land uses: **commercial/industrial** and recreational; future residential was also evaluated but later ruled out
- Receptors: **commercial/industrial worker, utility worker, construction worker,** trespasser, and recreationalist; future residents were also evaluated but later ruled out
- Exposure route: ingestion, direct contact, inhalation

Wooded Area - Northeast – soils

- Cancer risks within the acceptable risk range for all workers and child recreationalists
- Non-cancer hazards > 1 for construction worker only (3.5 for incidental ingestion of arsenic)
- Lead presents risk to construction workers only
- Land Uses: **recreational**
- Receptors: **recreationalist, utility worker, construction worker**, and trespasser
- Exposure route: ingestion, direct contact, inhalation

Building 100 Hotspot - soils

- Cancer risks exceed 1E-04 for commercial/industrial workers (both non-intrusive [3E-04] and intrusive [2E-04] scenarios)
- Cancer risks within acceptable risk range for all other receptors
- Non-cancer hazards > 1 for commercial/industrial worker and child recreationalists (1.3 to 62 for PCBs and metals)
- Lead presents risk to workers and child recreationalists
- Asbestos risk under non-intrusive scenarios to commercial/industrial workers only
- Land uses: **commercial/industrial** and recreational
- Receptors: **commercial/industrial worker, utility worker, construction worker**, recreationalist, and trespasser
- Exposure route: ingestion, direct contact, inhalation

Rolling Mill Area – soils

- Cancer risks within the acceptable risk range for all workers and child recreationalists
- Non-cancer hazards > 1 for all workers (2.6 to 200 for PCBs and metals)
- Lead presents risk to workers and child recreationalists
- Land uses: **commercial/industrial** and recreational
- Receptors: **commercial/industrial worker, utility worker, construction worker**, recreationalist, and trespasser
- Exposure route: ingestion, direct contact, inhalation

Off-Site Residential Area - soils

- Cancer risks for residents exceed 1E-04 at 26 of the 185 properties tested (2E-04 to 6E-04, driven primarily by arsenic)
- Cancer risks within the acceptable risk range for all workers
- Non-cancer hazards > 1 for construction workers (2.8 for incidental ingestion of arsenic)
- Non-cancer hazards >1 for residents, related primarily to zinc and to a lesser degree arsenic, antimony, cadmium, and manganese (1.1 to 64 for metals in homegrown produce)
- Lead concentrations > 400 mg/kg at 46 of the 185 properties tested
- Land uses: **residential**
- Receptors: **resident, utility worker, and construction worker**
- Exposure route: ingestion, direct contact, inhalation

Off-Site Mixed Use Area – soils

- Cancer risks within or below the acceptable risk range for all receptors
- Non-cancer hazards < 1 for all receptors
- Lead poses no risk to any receptor
- Asbestos poses no risk to any receptor
- Land Uses: **residential**
- Receptors: **resident, utility worker, and construction worker**
- Exposure route: ingestion, direct contact, inhalation

Groundwater

The State of Illinois has classified the groundwater at the M&H Site as Class II - General Resource Groundwater. The groundwater at the Site is not used as a source of potable water; no groundwater supply wells are present at either OU1 or OU2. Further, a City of LaSalle ordinance, in conjunction with an MOU between the City of LaSalle and Illinois EPA, legally prohibits drilling of water wells at both OU1 and OU2 in order to obtain a water supply. Nevertheless, the risk assessment evaluated hypothetical future ingestion, dermal, and inhalation exposure pathways assuming potable groundwater use to provide risk managers with quantitative risk and hazard calculations to support the evaluation of risk management measures regarding groundwater at the Site. (Even the future commercial/industrial worker scenarios assumed potable use of Site groundwater.) Cumulative risk from ingestion, dermal, and inhalation pathways were calculated in the risk assessment, but are not considered complete current or possible future pathways and, therefore, were not further considered for risk management decision-making. While groundwater was ultimately evaluated on a Site-wide basis, the risk assessment for each OU evaluated the groundwater beneath that specific portion of the Site and can be found in the Risk Assessment section of the RI.

Ecological Risk

As with the HHRA, separate ecological risk assessments were completed for OU1 and OU2. The results for each operable unit are summarized below.

OU1

OU1 was divided into three ecological habitats (see Figure 3): Carus Plant Area, Slag Pile Area, and LVR.

Carus Plant Area

The results of the SLERA for the Carus Plant Area indicated that concentrations of several constituents, primarily metals, in surface soil exceeded ecological screening values (ESVs), which was the SLERA metric for predicting potential adverse effects on terrestrial wildlife receptors. Maximum HQs for most metals were above the EPA threshold value of 1, and in several instances, maximum HQs approached or exceeded 100. Given the magnitude of the HQs at the Carus Plant Area, it was considered unlikely that the potential for ecological risk could be attributed to the conservative assumptions or inherent uncertainties of the SLERA. Therefore, additional evaluation (e.g., a BERA) was not conducted for this area. However, as an industrial use property, the Carus Plant Area has and will continue to have minimal value as ecological habitat. Consequently, potential risks to terrestrial ecological receptors do not warrant further consideration in the identification of PRGs for this portion of the Site.

Slag Pile Area

The Slag Pile Area is composed of waste material generated from the primary zinc smelting process. Relative to the natural landscape, the Slag Pile Area inherently represents highly-disturbed habitat. Results of the SLERA for surface soil at the Slag Pile Area indicate that concentrations of several constituents, primarily metals, exceed ESVs. Maximum HQs for most metals were above the EPA threshold value of 1, and in several instances, maximum HQs approached or exceeded 100. Given the magnitude and widespread distribution of these metals at the Slag Pile Area, it was considered unlikely that the potential for ecological risk could be attributed to the conservative assumptions or inherent uncertainties of the SLERA. Therefore, a BERA was not conducted for this area. To evaluate whether future vegetation and support of ecological receptors is feasible, a 21-day lettuce seed germination test was conducted during the RI. The results of the phytotoxicity test indicate Slag Pile Area soils are unlikely to support vegetation.

LVR

Results of the SLERA indicated that concentrations of constituents, primarily metals, in the sediment and surface water of the LVR exceed ESVs for benthic and aquatic receptors. Based on the habitat characterization, the LVR was identified as the most ecologically-valuable habitat associated with the M&H Site. Therefore, further evaluation in a BERA was conducted for the riverine/riparian habitat of the LVR.

The BERA emphasized site-specific approaches (e.g., measurement endpoints) to characterize ecological effects on selected assessment endpoints. Assessment endpoints evaluated in the BERA were specified to protect mammalian, avian, benthic macroinvertebrate, and fish receptors in order to ensure a viable ecological community in the LVR. Risks to mammalian and avian receptors were evaluated using food chain models (FCMs) and biotic and abiotic data obtained from the LVR. Risks to benthic invertebrates were evaluated using toxicity testing and results of a community assessment. Risks to aquatic (fish) receptors were also evaluated using results of a community assessment. When possible, data regarding benthic invertebrates and fish on Site were compared to data from an upstream reference reach not affected by Site activities.

In accordance with EPA guidance, the BERA combined each line of evidence (measurement endpoint results) through a process of weighing the evidence to characterize the overall status of the ecological community in the LVR. Based on the weight of evidence, the BERA supports the following conclusions:

- No unacceptable risks were identified for mammalian receptors (mink);
- For avian receptors (kingfisher), an HQ of 1.8 for zinc was the only instance of a constituent HQ above 1;
- According to toxicity testing results combined with the more site-specific biological community assessment and resulting macroinvertebrate index of biotic integrity and Macroinvertebrate Biotic Index metrics, the benthic macroinvertebrate community is functioning and viable; and
- According to the biological community assessment and resulting fish index of biotic integrity metrics, the aquatic (fish) community is functioning and viable.

Given the conservative assumptions in the FCMs and the lack of toxicity predicted for individual mammalian receptors, it is unlikely that the M&H Site is adversely affecting populations of upper trophic level receptors that feed/forage along the LVR adjacent to the M&H Site.

Together, these lines of evidence support a conclusion that the M&H Site is not significantly adversely affecting overall health of the ecological community of the LVR. As indicated above, some measurement endpoints suggest the possibility of limited impacts on the benthic community, but those effects, if any, are not consistently observed (e.g., no effects in the chronic toxicity tests and no acute effects at some sampled reaches along the M&H Site) and are difficult to attribute to contaminants at the M&H Site.

OU2

The following four major habitat areas were identified at OU2, as depicted on Figure 7:

- Main Industrial Area – highly disturbed (little or no vegetation); includes large portions of the Main Industrial Area
- Adjacent to the Main Plant – disturbed with vegetation (woodland/grassland); includes Building 100 Area, Rolling Mill Area, portions of the Main Industrial Area, and North Area
- Savannah – includes portions of North Area and Wooded Area - Northeast
- Oak-Hickory Woodland – includes Wooded Area - Northeast

Both a SLERA and a BERA were completed for the upland portion of OU2, consistent with EPA ecological risk assessment guidance. During the SLERA, maximum analyte concentrations in soil samples from each habitat area were compared to appropriate ESVs, and risks were identified within each habitat. These risks were associated with metals, pesticides, PCBs, and PAHs. Based on this information, a BERA was recommended for three of the four habitat areas: (1) Adjacent to the Main Plant – disturbed with vegetation (woodland/grassland), (2) Savannah, and (3) Oak-Hickory Woodland. Because of the poor quality of the habitat and the high levels of contamination in the Main Industrial Area, no BERA was conducted for this area.

The BERA used as many site-specific assumptions as possible so that the assessment would reflect Site conditions. The BERA took into account site-specific chemical analytical data, site-specific bioaccumulation information, FCMs, and available scientific literature. The BERA evaluated potential exposures to plants, soil invertebrates, and mammalian and avian receptors (e.g., herbivores, invertivores, omnivores, and carnivores) within the three habitats. Site-specific information was obtained regarding bioaccumulations of metals in above-ground and below-ground portions of vegetation, and bioaccumulations of metals in earthworms within Site soils. In addition, soil toxicity was evaluated by collecting soil samples within each habitat and subjecting the soils to a seed germination and root-and-shoot elongation test. The soil exposure point concentrations (EPCs) were calculated for each habitat (the lower of the 95% upper confidence limit on the mean or the maximum concentration), and these data were used to assess risks to the various potential receptors. For plants and soil invertebrates, the EPCs were compared to plant- and soil-invertebrate-specific screening values to assess risks. In addition, soil toxicity and bioaccumulation test results were evaluated as part of a weight-of-evidence evaluation. An FCM was used to assess risks to mammalian and avian receptors.

Results of the BERA indicated the following risks within the three areas evaluated:

- Adjacent to the Main Plant – plants, soil invertebrates, and mammalian and avian receptors were all found to be at risk due to metals contamination. The most common metals were antimony, lead, mercury, selenium, and zinc;
- Savannah – plants, soil invertebrates, and mammalian and avian receptors were all found to be at risk due to metals contamination. The most common metals were lead and zinc; and
- Oak-Hickory Woodland – plants, soil invertebrates, and mammalian (only invertivores) and avian receptors were found to be at risk due to metals contamination. The most common metals were chromium, selenium, and zinc.

Because the Adjacent to the Main Plant area and the Savannah are viewed as likely industrial properties for future land use, ecological risks were not used in formulating PRGs. The Oak-Hickory Woodland in the northeast portion of OU2 was more closely evaluated for remediation using ecological restoration as a goal.

The Oak-Hickory Woodland habitat includes a steep slope from the OU2 area down to the LVR, and the woodlands visually appeared insignificantly impacted (established woodlands and supporting understory habitat were observed). A number of uncertainties associated with the risks within the Oak-Hickory Woodlands likely led to an overestimation of risk to this habitat. In summary, these uncertainties are related to the following factors:

- Risks to plants and invertebrates were calculated based on No Observed Adverse Effect Levels (NOAELs) rather than Lowest Observed Adverse Effect Levels (LOAELs), but the plant community present at the Site, as well as bioassay results, imply that the impacts have not been as great on this habitat as would be expected based on the numbers alone.

- FCM results based on LOAELs and maximum concentrations indicated potential impacts. However, the most significant exposure pathway is soil ingestion, and the FCM does not consider bioavailabilities of metals in the soils. Low bioavailabilities of metals are expected because of the pyroclastic composition of the material at the Site.

The Oak-Hickory Woodland habitat adjacent to the LVR appears to be stable and viable, and the community apparently is not significantly impacted by elevated metal concentrations in the soils. The most likely remedial action for this area of the Site would be removal of the upper layer of soils. This could be accomplished only by removing a significant amount of vegetation in the process, in turn significantly destabilizing the soil, increasing potential for erosion, and posing a long-term threat to the LVR from surface water runoff. Based on this weight of evidence, EPA concluded that the Wooded Area - Northeast would not benefit from remedial action, and the habitat should be allowed to continue its recovery. This conclusion is outlined in a Technical Memorandum dated October 10, 2013, which is included in the Administrative Record.

Risk Assessment Conclusion

In EPA's judgment, the Preferred Alternatives identified in this Proposed Plan, or some of the other active measures considered in the Proposed Plan, are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

RAOs are goals for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs were developed for the M&H Site based on the contaminant levels and exposure pathways that present current and/or future unacceptable risk to human health and the environment. Although each OU at the Site was subdivided into separate EAs during the risk assessment, the RAOs below were developed for each OU based on the media and areas that presented risks that need to be addressed; the RAOs are not necessarily broken down by the various EAs evaluated in the risk assessment.

Site-Specific RAOs

The following RAOs were developed to address the risks identified at the M&H Site.

<u>OU1</u>

- Minimize or reduce the potential for ingestion, direct contact with, and inhalation of Site COCs in impacted soils/solid matrices at the Carus Plant Area that could result in unacceptable human health risk to current or future commercial or industrial workers as determined in the HHRA.

- Minimize or reduce the potential for ingestion, direct contact with, and inhalation of Site COCs in impacted soils/solid matrices at the Slag Pile Area that could result in unacceptable human health risk to current or future commercial/industrial workers, current or future utility workers, or future construction workers as determined in the HHRA.

- Reduce surface water runoff and erosion of material from the Slag Pile slope to prevent any unacceptable risks to any current or future human or ecological receptors and to protect the remedy being implemented.

OU2

- Site Property Soils (Main Industrial Area, North Area, Wooded Area-Northeast, Building 100 Hot Spot, Rolling Mill Area): Minimize or reduce the potential for exposure to metals, PCBs, PAHs, VOCs and asbestos through ingestion of, inhalation of, or direct contact with soil that could result in unacceptable risks for current and future commercial/industrial workers, current and future utility workers, or future construction workers as determined in the HHRA.

- Off-Site Residential Area: Prevent direct contact with, or ingestion or inhalation of, COCs in affected soils at residential properties by current residential or potential future residential receptors that could result in an unacceptable human health risk as determined in the HHRA.

There are no RAOs for groundwater because EPA believes that groundwater does not warrant response action under CERCLA. As discussed earlier, Illinois EPA has classified the groundwater at the M&H Site as Class II - General Resource (i.e., non-potable) groundwater. There are no groundwater supply wells at the M&H Site and groundwater is not used for potable or industrial uses, including irrigation; and the groundwater is not appropriate for use as a potable source in the future. Further, an ordinance of the City of LaSalle, in conjunction with an MOU between the City and Illinois EPA, legally prohibits the drilling of water wells throughout the City of LaSalle for the purpose of obtaining a water supply, so ICs prohibiting the use of groundwater as a water supply are already in place. Although there are exceedances of the State's Class II standards, those standards are not health-based standards and, therefore, do not pose an unacceptable risk to human health or the environment.

Preliminary Remediation Goals

PRGs are risk-based, background-based, or ARAR-based chemical-specific concentrations that help further define the RAOs and that are used in developing and evaluating potential cleanup alternatives for a Site. PRGs are considered "preliminary" remediation goals until a remedy is selected in a ROD. The ROD establishes the final remedial goals and/or cleanup levels.

EPA developed PRGs[1] for the M&H Site based on the RAOs listed above. The PRGs are based on both protective risk-based calculations (considering the risk range of 1E-04 to 1E-06) and a

[1] It should be noted that the FS Report mistakenly used the term "Remedial Action Levels" (RALs) instead of "Preliminary Remediation Goals" (PRGs).

review of the potential federal and state ARARs. A list of all the PRGs for the Site is included in Table 2.

For lead in soil, health-based PRGs were calculated for residents and non-residents using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children and the Adult Lead Methodology (ALM), respectively. Using default input parameters, the resulting PRGs for lead in soil were 400 mg/kg for residential properties and 800 mg/kg for commercial/industrial properties. EPA also performed site-specific bioavailability testing for lead and arsenic in the residential area to determine the bioavailability of those metals to receptors in the community. Site-specific results for lead were slightly higher than the default number. Ultimately, EPA decided to use the default bioavailability value for both lead and arsenic rather than the site-specific bioavailability data. This resulted in soil PRGs of 400 mg/kg (residential) and 800 mg/kg (commercial/industrial) for lead and 18 mg/kg for arsenic[2] (residential).

When establishing the arsenic PRG for properties with current or future residential land use, EPA evaluated a range of potential PRGs. EPA considered PRGs based on excess lifetime cancer risk levels of 1E-06, 1E-05, and 1E-04, a non-cancer HI of 1, and site-specific background concentrations (11.8 mg/kg). Arsenic PRGs based on risk levels of 1E-06 and 1E-05 are below background and not achievable, so those risk levels were ruled out. An arsenic PRG based on an HI of 1 is lower (more protective) than a PRG based on a risk level of 1E-04, so the 1E-04 risk level was ruled out. A PRG based on site-specific background concentrations is lower (and more protective) than one based on an HI of 1. The risk levels associated with PRGs based on site-specific background and an HI of 1 are as follows:

Basis	Arsenic Concentration	Risk Level
Background	11.8 mg/kg	5E-05
HI = 1	18 mg/kg	8E-05

Both of the above potential PRGs are within the acceptable risk range – they both fall between excess lifetime cancer risk levels of 1E-05 to 1E-04 – and the difference between their risk estimates is minimal. After evaluating the cleanup alternatives against the NCP evaluation criteria described below (see the "Evaluation of Alternatives" section), and considering the need to make a cost-effectiveness finding, EPA made the risk-management decision to propose an arsenic PRG of 18 mg/kg. EPA concluded that the $10 million cost increase associated with a PRG based on background is significant and would result in only limited risk reduction. The proposed PRG of 18 mg/kg would result in a cleanup that is both protective of human health and cost-effective. Based on the sampling conducted during the RI, and using an arsenic PRG of 18 mg/kg, approximately 3,000 of the 5,000 residential properties in the Off-Site Residential Area portion of OU2 are estimated to require cleanup.

[2] The arsenic PRG of 18 mg/kg is different than the PRG reflected in the FS Report. See November 7, 2014 Technical Memorandum (included in Administrative Record file) for a detailed discussion of the arsenic PRG.

SUMMARY OF REMEDIAL ALTERNATIVES

In order to address the RAOs described above, a variety of remedial alternatives were developed for each EA of the M&H Site that posed unacceptable risk. A full list of the remedial alternatives that were developed, along with a short narrative description of each, is provided in Appendix 1. The remedial alternatives listed and briefly described below are those that were carried through the FS for detailed evaluation. The costs provided below are estimated present worth costs. A more detailed description of each alternative that was carried through the FS, including more details about the cost of each alternative, is provided in Appendix 2, and additional details about each alternative are contained in the FS Report and other documents located in the Administrative Record file.

For each alternative below that includes on-site consolidation of excavated soils, there is a possibility that some of the excavated soils will be identified as being characteristically hazardous due to toxicity. This is because some of the soil samples collected during the RI exceeded the maximum concentration related to toxicity characteristic regulatory levels, based on TCLP results. During the remedial design, this issue will be further evaluated to determine whether characteristically hazardous soils can be treated, via chemical stabilization, to non-hazardous levels and then contained on Site, or whether they need to be transported off-site for disposal.

For each alternative below, excluding the No Action alternative, it is assumed that some type of IC will be needed for each area. The cleanup objectives for the ICs would be to prevent exposure to and disturbance of wastes and contaminated soils, interference with the remedy, and usage of groundwater at the Site. These would be accomplished by various ICs such as environmental covenants, deed restrictions, or property access restrictions. The type and placement of each IC will be determined during the remedial design phase of the project.

OU1

Carus Plant Area

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.
- Alternative 4 - Excavation (with Off-Site Disposal)
  Excavate areas of the Carus Plant Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport wastes off-site for disposal. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 4.2 months, and the cost is $6.39 million.
- Alternative 5 - Low Permeability Cover
  Install an engineered low-permeability cover to isolate impacted soil at the Carus Plant Area from commercial/industrial, utility, and construction workers. The cover may consist of a synthetic material, clay, or paving; asphalt paving is a likely option as the majority of the plant Site is currently paved. Remove a small quantity of accumulated soil and vegetation from a gravel-paved storage area and consolidate the

materials in the on-site slag pile prior to installation of the low-permeability cover over the gravel area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is ½ month, and the cost is $1.57 million.

- Alternative 6 - Soil Cover ***[EPA's Preferred Alternative]***
  Install an engineered soil cover to isolate impacted soil at the Carus Plant Area from commercial/industrial, utility, and construction workers. Remove a small quantity of accumulated soil and vegetation from a gravel-paved storage area and consolidate the materials in the on-site slag pile prior to installation of asphalt over the gravel area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is one month, and the cost is $1.67 million.

Slag Pile Area (including Slope Stability)

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.
- Alternative 4 - Excavation (with Off-Site Disposal)
  Excavate areas at the Slag Pile Area with soil concentrations above acceptable commercial/industrial human health risk levels (this assumes that all slag would be removed). Transport excavated materials off-site for disposal. Backfill the excavated areas. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 22 months, and the cost is $214.1 million.
- Alternative 5 - Low Permeability Cover
  Install an engineered low-permeability cover to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. The cover may consist of a synthetic material or clay. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is 9 months, and the cost is $7.31 million.
- Alternative 6 - Soil Cover ***[EPA's Preferred Alternative]***
  Install an engineered soil cover to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is 9 months, and the cost is $7.09 million.

- Alternative 12 - Excavation (with On-Site Consolidation on OU2)
  This alternative is the same as Alternative 4 except that the excavated materials from the Slag Pile Area would be taken to OU2 for consolidation in an on-site consolidation area instead of being transported off-site for disposal. The time needed to implement this alternative is 22 months, and the cost is $101.6 million.

The following alternatives would physically stabilize the slope of the slag pile and would reduce surface runoff and slope erosion. These alternatives may be implemented in conjunction with Alternatives 5 or 6 above.

- Alternative 14 - Sloping and Benching + Revetments[3] at the Toe of the Slope + Best Management Practices (BMPs)
  Remove existing vegetation from the slag pile. Excavate, slope, bench the slag pile along the LVR, and install a 2-foot-thick engineered soil cover. Install revetments at the toe of the slope for erosion protection along the river. Implement BMPs, including seeding for the soil cover. Implement additional BMPs such as straw wattles, graded bench with check dams and rip-rapped down chutes, and top of slope surface runoff control berms and graded surface swales. The time needed to implement this alternative is 10 months, and the cost is $18.25 million.

- Alternative 15 - Sloping and Benching + Plantings + Revetments at the Toe of the Slope + BMPs ***[EPA's Preferred Alternative]***
  This alternative is the same as Alternative 14 except for the addition of high-density tree planting to further stabilize the slope of the slag pile. The time needed to implement this alternative is 10 months and the cost is $18.42 million.

OU2

<u>Main Industrial Area</u>

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.

- Alternative 2 - Soil Excavation + On-Site Consolidation under a Soil Cover ***[EPA's Preferred Alternative]***
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site engineered consolidation area at the Main Industrial Area. If soils that fail TCLP are present, these will be treated in-situ and placed within the consolidation area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is 27 months, and the cost is $34.9 million.

- Alternative 3 - Ex-Situ Chemical Stabilization
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use chemical stabilization to treat the excavated materials at an on-site treatment location within the Main Industrial Area.

[3] Revetments are structures that would provide erosion control armoring at the toe of the slope of the slag pile.

This would reduce the mobility and bioavailability of the COCs and decrease risks to acceptable levels. Use the treated, stabilized soil as backfill material at the original excavation location. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 37 months, and the cost is $80.4 million.

- Alternative 4 - Soil Excavation + Ex-Situ Treatment by Soil Washing
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use soil washing to treat the excavated materials at an on-site soil-washing treatment location within the Main Industrial Area, to reduce concentrations of COCs to acceptable levels. Use the treated soil as backfill material at the original excavation location. Transport and dispose of washing wastewater and dewatered sludge at an off-site facility. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 79 months, and the cost is $204 million.

- Alternative 5 - Soil Excavation + Off-Site Disposal
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport the excavated materials off-site for disposal. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 47 months, and the cost is $137 million.

North Area

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.

- Alternative 2 - ICs Only
  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs. The time needed to implement this alternative is one month, and the cost is $0.28 million.

- Alternative 3 - Phytoremediation
  Treat soil contaminants at the North Area through phytoremediation. Install appropriate plants that specialize in uptake of the various COCs. Harvest plants up to two times per season (including at the end of each growing season) and transport off-site for disposal. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The time needed to implement this alternative is one month, and the cost is $13.3 million.

- Alternative 4 - Soil Excavation + On-Site Consolidation under a Soil Cover ***[EPA's Preferred Alternative]***
  Excavate areas at the North Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site engineered consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 8 months, and the cost is $19.6 million.

- Alternative 5 - Soil Excavation + Off-Site Disposal
  This alternative is the same as Alternative 4 above except that the excavated materials from the North Area would be transported off-site for disposal instead of being consolidated in the on-site engineered consolidation area at the Main Industrial Area. The time needed to implement this alternative is 8 months, and the cost is $45.9 million.

<u>Building 100 Area</u>

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.

- Alternative 2 - ICs Only
  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs. The time needed to implement this alternative is one month, and the cost is $0.43 million.

- Alternative 3 - Soil Excavation + On-Site Consolidation under a Soil Cover ***[EPA's Preferred Alternative]***
  Excavate areas at the Building 100 Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site engineered consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 5 months, and the cost is $4.0 million.

- Alternative 4 - Soil Excavation + Off-Site Disposal
  This alternative is the same as Alternative 3 above except that the excavated materials from the Building 100 Area would be transported off-site for disposal instead of being consolidated in the on-site engineered consolidation area at the Main Industrial Area. The time needed to implement this alternative is 6 months, and the cost is $12.0 million.

<u>Rolling Mill Area</u>

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.

- Alternative 2 - ICs Only

  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs. The time needed to implement this alternative is one month, and the cost is $0.47 million.

- Alternative 3 - Soil Excavation + On-Site Consolidation under a Soil Cover ***[EPA's Preferred Alternative]***

  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site engineered consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 4 months, and the cost is $4.5 million.

- Alternative 4 - Soil Excavation + Ex-Situ Treatment by Soil Washing

  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use soil washing to treat the excavated materials at an on-site soil-washing treatment location within the Main Industrial Area to reduce concentrations of COCs to acceptable levels. Use the treated soil as backfill material at the original excavation location. Transport and dispose of washing wastewater and dewatered sludge at an off-site facility. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 6 months, and the cost is $13.8 million.

- Alternative 5 - Soil Excavation + Off-Site Disposal

  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport the excavated materials off-site for disposal. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial. The time needed to implement this alternative is 4 months, and the cost is $9.6 million.

Off-Site Residential Area

During the RI, 200 of the roughly 5,000 properties in the Off-Site Residential Area were tested. In order to estimate the number of properties that are likely to require cleanup, the Off-Site Residential Area was divided into four zones, based on the density of properties sampled during the RI and distance from the on-site areas of OU2. Based on the RI sampling, EPA estimates that approximately 3,000 properties will require cleanup. Due to the large number of properties that are likely to require cleanup, and the length of time that would be required before all the properties could be addressed, EPA would likely use a phased approach for the residential cleanup activities. Properties might be prioritized in order to address properties with higher concentrations of COCs first, where sensitive receptors are present, and/or where children with elevated blood lead levels are present. These decisions would be made during the remedial design phase.

- Alternative 1 - No Action
  No action will be taken to mitigate risk. No cost is associated with this alternative.
- Alternative 2 - On-Site Soil Cover
  Cover contaminated soil at impacted properties in the Off-Site Residential Area with a 1-foot-thick soil cover. Implement land-use restrictions at impacted properties to exclude gardens (except for raised-bed gardens using imported clean soil) and to protect the constructed remedy components. The time needed to implement this alternative is 148 months, and the cost is $128 million.
- Alternative 3 - Soil Excavation + On-Site Consolidation under a Soil Cover ***[EPA's Preferred Alternative]***
  Excavate contaminated soil at impacted properties in the Off-Site Residential Area to a maximum depth of 24 inches. Consolidate excavated materials in an on-site engineered consolidation area at the Main Industrial Area. If contamination remains in place deeper than 24 inches, install a visual barrier on top of the underlying contamination prior to backfilling with clean soil, and implement land-use restrictions as appropriate. The time needed to implement this alternative is 177 months, and the cost is $113 million.
- Alternative 4 - Soil Excavation + Off-Site Disposal
  This alternative is the same as Alternative 3 above except that the excavated materials from the Off-Site Residential Area would be transported off-site for disposal instead of being consolidated in the on-site engineered consolidation area at the Main Industrial Area. The time needed to implement this alternative is 176 months, and the cost is $157 million.

EVALUATION OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies offering the most effective and efficient means of achieving Site cleanup goals. While all nine criteria are important, they are weighed differently in the decision-making process depending on whether they evaluate protection of human health and the environment or compliance with federal and state ARARs (threshold criteria), consider technical or economic merits (primary balancing criteria), or involve the evaluation of non-EPA reviewers that may influence an EPA decision (modifying criteria). These nine criteria are described below, followed by a discussion of how each alternative meets or does not meet each criterion.

Explanation of the Nine Evaluation Criteria

Threshold Criteria

1. ***Overall protection of human health and the environment:*** Alternatives are evaluated to determine whether they can protect human health and the environment from unacceptable

risks posed by hazardous substances, pollutants, or contaminants by eliminating, reducing, or controlling exposures.

2. ***Compliance with ARARs:*** Alternatives are evaluated to determine whether they attain requirements under federal, tribal, and state environmental laws and regulations, or provide grounds for invoking a waiver. This evaluation includes a review of whether alternatives can meet chemical-specific, action-specific, and location-specific ARARs.

Primary Balancing Criteria

3. ***Long-term effectiveness and permanence:*** Alternatives are evaluated for the degree of long-term effectiveness and permanence they provide and for the degree of certainty that the alternative will prove to be successful.

4. ***Reduction of toxicity, mobility, or volume through treatment:*** Alternatives are evaluated to determine the degree to which they employ treatment to reduce the toxicity, mobility, or volume of the Site contaminants.

5. ***Short-term effectiveness:*** Short-term impacts on the community and workers during implementation of alternatives are evaluated. Such impacts include transportation (including noise, dust, and traffic hazards), protection of workers, and the timeframe for implementing the remedy. This criterion also considers the effectiveness of mitigative measures until protection is achieved through attainment of the RAOs.

6. ***Implementability:*** The ease of implementing alternatives is evaluated, considering technical difficulties and reliability of various technologies, coordination with other offices and agencies, and availability of services and materials.

7. ***Cost:*** Capital costs and ongoing, long-term costs are evaluated. The estimated costs for each alternative have an expected accuracy of +50 percent to -30 percent.

Modifying Criteria

8. ***State Acceptance:*** The State's position and key concerns on the preferred alternative and other alternatives are considered, as well as comments on ARARs or proposed use of waivers. This assessment is completed after the State's comments on the Proposed Plan are received.

9. ***Community Acceptance:*** The community's support of, reservations about, or opposition to components of the alternatives are considered. This assessment is completed after public comments on the Proposed Plan are received.

Comparison of Alternatives

The FS Report contains a detailed discussion of the comparative analysis of alternatives, where the various alternatives for each area of the Site are compared against each other in terms of how they fare against the nine evaluation criteria. Table 3 provides an overall summary of the comparative analysis, and Table 4 provides a more detailed description of the comparative analysis, including the rankings and scoring of each alternative. Note that the "Cost" information in Table 4 often provides three costs for each alternative; these represent the estimated costs for cleanup to the 1E-04, 1E-05, and 1E-06 risk levels, as PRGs had not yet been selected.

A narrative summary of the comparative analysis of alternatives is provided below.

Overall Protection of Human Health and the Environment

For each separate area of the Site, all of the retained alternatives – with the exception of each area's "no action" alternative – would protect human health and the environment. Because the "no action" alternative (Alternative 1 in each instance) would not protect human health and the environment, Alternative 1 was eliminated from consideration and will not be discussed under the remaining eight criteria. For all of the remaining alternatives, RAOs would be achieved immediately upon completion of the construction. The discussion below summarizes how the remaining alternatives for each area would achieve protectiveness.

OU1

- ***Carus Plant Area:*** Alternative 4 would meet the RAOs by excavating and transporting off-site for disposal all wastes posing unacceptable risks. Alternatives 5 and 6 would meet the RAOs by covering with a low-permeability cover and a soil cover, respectively, those areas of the plant that pose an unacceptable risk. Alternatives 4, 5, and 6 all would include the use of ICs, along with property access restrictions, to limit this area of the Site to commercial/industrial land use.

- ***Slag Pile Area (including Slope Stability):*** Alternative 4 would meet the RAOs by excavating and transporting off-site for disposal all wastes posing unacceptable risks. Alternatives 5 and 6 would meet the RAOs by covering with a low-permeability cover and a soil cover, respectively, slag pile soils that pose an unacceptable risk. Alternative 12 would meet the RAOs by excavating and placing in an on-site, engineered consolidation area all wastes posing unacceptable risks. Slope stability Alternatives 14 and 15 would meet the RAOs by reducing surface runoff and erosion from the slag pile. Alternatives 4, 5, and 6 would include the use of ICs, along with property access restrictions, to limit this area of the Site to commercial/industrial land use.

OU2

- ***Main Industrial Area:*** Alternative 2 would meet RAOs by excavating and placing in an on-site, engineered consolidation area all wastes posing unacceptable risks. Alternative 3 would meet RAOs by excavating contaminated soils, mixing them with a chemical stabilizer, and returning the stabilized soils to their original location. Alternative 4 would meet RAOs by using soil-washing to treat excavated soils and returning the treated soils to their original location. Alternative 5 would meet RAOs by excavating and transporting off-site for disposal all wastes posing unacceptable risks. Alternatives 2, 3, 4, and 5 all would include the use of ICs, along with property access restrictions, to limit this area of the Site to commercial/industrial land use.

- ***North Area:*** Alternative 2 would meet RAOs by limiting potential exposures to the contamination through the use of institutional controls. Alternative 3 would use phytoremediation to meet RAOs. Alternatives 4 and 5 would meet RAOs by excavating all wastes posing unacceptable risks and either consolidating them in an on-site consolidation area or transporting them off-site for disposal, respectively.

- ***Building 100 Area:*** Alternative 2 would meet RAOs by limiting potential exposures to the contamination through the use of institutional controls. Alternatives 3 and 4 would meet RAOs by excavating all wastes posing unacceptable risks and either consolidating them in an on-site consolidation area or transporting them off-site for disposal, respectively.

- ***Rolling Mill Area:*** Alternative 2 would meet RAOs by limiting potential exposures to the contamination through the use of institutional controls. Alternatives 3 and 5 would meet RAOs by excavating all wastes posing unacceptable risks and either consolidating them in an on-site consolidation area or transporting them off-site for disposal, respectively. Alternative 4 would meet RAOs by treating excavated soils, using soil-washing technology, before using the treated soils as backfill materials.

- ***Off-Site Residential Area:*** Alternative 2 would meet RAOs by covering contaminated soils with a clean soil cover to minimize direct contact with the contamination, and by using institutional controls to ensure the soil cover remains intact and undisturbed. Alternatives 3 and 4 would meet RAOs by excavating all soils posing unacceptable risks and either consolidating them in an on-site consolidation area or transporting them off-site for disposal, respectively.

Compliance with ARARs

For each separate area of the Site, all of the retained remedial action alternatives would comply with their respective ARARs from federal and state laws. The key State ARARs that the selected alternative would need to address are:

- 35 IAC Part 228.141: Asbestos
- 35 IAC Part 620: Groundwater Quality
- 35 IAC Part 742: Tiered Approach to Correction Action Objectives

- 35 IAC Part 807.305c and 807.502: Final Cover and Closure Standards
- 765 ILCS 122: Illinois Uniform Environmental Covenants Act

The main Federal ARARs that the selected alternative would need to address are:

- Safe Drinking Water Act of 1974
- Clean Water Act of 1977
- Resource Conservation and Recovery Act of 1976
- Endangered Species Act

- Fish and Wildlife Coordination Act
- Toxic Substances Control Act

Long-Term Effectiveness and Permanence

OU1

- ***Carus Plant Area:*** Alternative 4 would provide the highest degree of long-term effectiveness and permanence through the excavation and off-site disposal of contaminated soil exceeding PRGs. Alternatives 5 and 6 would rely on continued maintenance of a cover over contaminated soils to ensure long-term effectiveness and permanence.

- ***Slag Pile Area (including Slope Stability):*** Alternatives 4 and 12 would provide the highest degree of long-term effectiveness and permanence through the excavation of all slag pile soils that pose a risk; Alternative 4 would transport the excavated soils off-site for disposal, and Alternative 12 would manage them in an on-site consolidation area. Alternatives 5 and 6 would rely on continued maintenance of a cover over the slag pile to ensure long-term effectiveness and permanence. When used in conjunction with either Alternative 5 or Alternative 6, slope stability Alternative 15 would provide slightly better permanence and erosion control than Alternative 14 due to the addition of plantings along the slope.

OU2

- ***Main Industrial Area:*** Alternatives 2 and 5 would provide the highest degree of long-term effectiveness and permanence through the excavation of all soils that pose a risk; Alternative 5 would transport the excavated soils off-site for disposal, and Alternative 2 would manage the excavated soils in an on-site consolidation area. The long-term effectiveness and permanence of Alternative 3 would depend on the reliability of the chemical stabilizer used to treat the excavated soils, including the ability of the stabilizer to withstand weather conditions over the long term that may cause it to break down, reducing its effectiveness. Alternative 4 is considered less effective than Alternatives 2, 3, and 5 because ex-situ treatment by soil washing may be less effective on non-metal COCs, such as PCBs and PAHs, than on metals.

- ***North Area:*** Alternatives 4 and 5 would provide the highest degree of long-term effectiveness and permanence through the excavation of all soils that pose a risk; Alternative 5 would transport the excavated soils off-site for disposal, and Alternative 4 would manage the excavated soils in an on-site consolidation area. The ability of Alternative 3 to provide long-term effectiveness and permanence depends on a number of factors, including identifying the correct variety of plants during remedial design that would uptake the range of COCs in the North Area. Phytoremediation would require multiple harvesting events and is limited to the root depth of the plants; Alternative 3 would, therefore, rely on ICs to leave deeper soils undisturbed. Alternative 2 is considered less effective than the other alternatives because it does not include remedial action components that contain or reduce COC concentrations in soil and ICs would be the only mechanism used to address risks.

- ***Building 100 Area:*** Alternatives 3 and 4 would provide the highest degree of long-term effectiveness and permanence through the excavation of all soils that pose a risk; Alternative 4 would transport the excavated soils off-site for disposal, and Alternative 3 would manage the excavated soils in an on-site consolidation area. Alternative 2 is considered less effective than the other alternatives because it does not include remedial action components that contain or reduce COC concentrations in soil and ICs would be the only mechanism used to address risks.

- ***Rolling Mill Area:*** Alternatives 3 and 5 would provide the highest degree of long-term effectiveness and permanence through the excavation of all soils that pose a risk; Alternative 5 would transport the excavated soils off-site for disposal, and Alternative 3 would manage the excavated soils in an on-site consolidation area. Alternative 4 is considered less effective than Alternatives 3 and 5 because ex-situ treatment by soil washing may be less effective on non-metal COCs, such as PCBs and PAHs, than on metals. Alternative 2 is considered less effective than the other alternatives because it does not include remedial action components that contain or reduce COC concentrations in soil and ICs would be the only mechanism used to address risks.

- ***Off-Site Residential Area:*** Alternatives 3 and 4 would provide the highest degree of long-term effectiveness and permanence through the excavation of all soils that pose a risk; Alternative 4 would transport the excavated soils off-site for disposal, and Alternative 3 would manage the excavated soils in an on-site consolidation area. Alternative 2 is considered less effective than the other alternatives because ICs would be needed at numerous residential properties to ensure that the soil cover remains undisturbed and it would be difficult to monitor and enforce the ICs.

Reduction of Toxicity, Mobility, or Volume through Treatment

OU1

- ***Carus Plant Area:*** None of the Carus Plant Area alternatives include a treatment component to reduce the toxicity, mobility, or volume of the contaminated soils.

- ***Slag Pile Area (including Slope Stability):*** None of the Slag Pile Area alternatives include a treatment component to reduce the toxicity, mobility, or volume of the contaminated soils.

OU2

- ***Main Industrial Area:*** Alternatives 3 and 4 both include the use of treatment technologies. Alternative 3 would chemically stabilize COCs in soils and would reduce their mobility, but would not reduce their toxicity or volume. Alternative 4 would reduce the mass of COCs in soil with ex-situ soil-washing technology. By reducing the COC mass, the toxicity of soil and the mobility and volume of the COCs in soil would also be reduced, making Alternative 4 rank the highest in this category. Alternatives 2 and 5 do not include a treatment component.

- ***North Area:*** Alternative 3 is the only North Area alternative that includes a treatment component. Alternative 3 would reduce the mobility and volume of COCs by removing contaminants from soil and concentrating them in plants, which would then be harvested and sent off-site for disposal. This alternative would not reduce the toxicity of the contaminants that would remain in the plants.

- ***Building 100 Area:*** None of the Building 100 Area alternatives include a treatment component to reduce the toxicity, mobility, or volume of the contaminated soils.

- ***Rolling Mill Area:*** Alternative 4 is the only Rolling Mill Area alternative that includes a treatment component. Alternative 4 would reduce the mass of COCs in soil with ex-situ soil-washing technology. By reducing the COC mass, the toxicity of soil and the mobility and volume of the COCs in soil would also be reduced.

- ***Off-Site Residential Area:*** None of the Off-Site Residential Area alternatives include a treatment component to reduce the toxicity, mobility, or volume of the contaminated soils.

Short-Term Effectiveness

OU1

- ***Carus Plant Area:*** Alternative 4 would pose greater potential short-term impacts to the workers conducting the cleanup than Alternatives 5 and 6 because more excavation of contaminated soils is associated with that alternative. Alternative 4 would also involve excavation near existing infrastructure and utilities, but such risks would be minimized through development and implementation of appropriate health and safety protocols. Appropriate dust control measures would be used during implementation of all three alternatives to control particulate emissions during excavation and/or cover installation.

- ***Slag Pile Area (Including Slope Stability):*** Alternatives 4, 5, 6, 12, 14, and 15 would all pose moderate to high risks to the workers conducting the cleanup work due to the steep and potentially-unstable slopes associated with the slag pile. However, these risks would be minimized through development and implementation of appropriate health and safety protocols. Other potential short-term impacts common to all alternatives include particulate emissions during excavation and/or cover installation, but these risks would be controlled through appropriate dust control measures. Alternatives 4 and 12 would pose greater potential short-term impacts to the workers conducting the cleanup than the other alternatives because Alternatives 4 and 12 include excavation of the entire contaminated slag pile, but such risks would be minimized through development and implementation of appropriate health and safety protocols. Alternatives 4 and 12 also would take much longer to implement than Alternatives 5 and 6, so the timeframe to reach RAOs would be longer. Alternative 4 would pose greater short-term risks to the community than all the other alternatives because of the significant amount of truck traffic needed for off-site disposal of the entire slag pile.

OU2

- ***Main Industrial Area:*** Alternatives 2, 3, 4, and 5 would all pose potential short-term impacts to workers due to potential exposure to contaminated soil, since all of these alternatives involve the excavation of all soils exceeding PRGs. These risks would be minimized through development and implementation of appropriate health and safety protocols. Measures would be taken during implementation of all remedial alternatives to limit the risk of off-site migration of particulate emissions during remedial activities. Alternative 5 would pose greater short-term risks to the community than all of the other alternatives because of the significant amount of truck traffic required for off-site disposal of a significant volume of contaminated soils.

- ***North Area:*** Alternative 2 would pose no short-term impacts to workers or the community because no active remedial measures would be implemented. Alternative 3 would pose only minimal short-term impacts, since the main remedial activities would be planting, weeding, fertilizing, and harvesting the plants. Alternatives 4 and 5 would pose greater short-term impacts to the workers conducting the cleanup than the other alternatives because Alternatives 4 and 5 include excavation of all contaminated soils. These risks would be minimized through development and implementation of appropriate health and safety protocols. Alternative 5 would pose somewhat greater short-term impacts to the community than the other alternatives because the excavated soils would be transported off-site for disposal, requiring truck traffic through the community.

- ***Building 100 Area:*** Alternative 2 would pose no short-term impacts to workers or the community because no active remedial measures would be implemented. Alternative 3 would pose only minimal short-term impacts, since the amount of contaminated soils being excavated and handled is relatively small. Alternative 4 would pose somewhat greater short-term impacts to the community than the other alternatives because the excavated soils would be transported off-site for disposal, requiring truck traffic through the community.

- ***Rolling Mill Area:*** Alternative 2 would pose no short-term impacts to workers or the community because no active remedial measures would be implemented. Alternatives 3 and 4 would pose only minimal short-term impacts, since the amount of contaminated soils being excavated and handled is relatively small. Alternative 5 would pose somewhat greater short-term impacts to the community than the other alternatives because the excavated soils would be transported off-site for disposal, requiring truck traffic through the community.

- ***Off-Site Residential Area:*** Alternatives 2, 3, and 4 would all pose short-term impacts to the community and workers during implementation, as all three alternatives involve truck traffic through the community over a significant period of time. The short-term impacts associated with Alternative 2 would be less than those associated with Alternatives 3 and 4, since most of the contaminated soils would remain in place undisturbed (e.g., not excavated) and covered with clean soil. Alternatives 3 and 4 include additional short-term impacts associated with the excavation and transportation – either back to the main portion of OU2 or to an off-site disposal facility – of all contaminated soils. Air monitoring and dust control measures would be implemented during the construction work to limit the risk to residents and on-site personnel.

Implementability

OU1

- ***Carus Plant Area:*** Alternatives 5 and 6 would be the simplest to implement. Alternative 4 would pose some challenges during implementation, including excavating in the vicinity of existing Site pavement and structures and coordinating the excavation work to minimize disruption to plant operations, but these challenges would not be difficult to overcome.

- ***Slag Pile Area:*** Alternatives 4 and 12 would be difficult to implement because the entire slag pile, including materials beneath the water table, would need to be excavated and moved. Alternatives 5 and 6 would be relatively easier to implement than Alternatives 4 and 12, particularly when implemented in conjunction with either Alternative 14 or 15. Extra care would be needed to ensure safe access for workers and equipment during sloping, benching, and revetment construction.

OU2

- ***Main Industrial Area:*** All of the Main Industrial Area alternatives could be readily implemented. The treatment technologies used in Alternatives 3 and 4 are widely-used and available. However, Alternative 4 would require the excavation area to remain open while the excavated soil undergoes the soil-washing treatment, and the open excavation would need to be managed to deal with rain water and infiltrating groundwater, making it not quite as easily implemented as the other alternatives.

- ***North Area:*** All of the North Area alternatives are considered implementable.

- ***Building 100 Area:*** All of the Building 100 Area alternatives could be readily implemented.

- ***Rolling Mill Area:*** All of the Rolling Mill Area alternatives could be readily implemented. The treatment technology used in Alternative 4 is widely-used and available. However, Alternative 4 would require the excavation area to remain open while the excavated soil undergoes the soil-washing treatment, and the open excavation would need to be managed to deal with rain water and infiltrating groundwater, making it not quite as easily implemented as the other alternatives.

- ***Off-Site Residential Area:*** Alternative 2 would be difficult to implement, since installing a soil cover would require raising the grade of a yard and would cause technical and administrative challenges. Alternatives 3 and 4 are considered implementable.

Cost

OU1

- ***Carus Plant Area:*** Alternative 4 is the most costly Carus Plant Area alternative. Alternatives 5 and 6 have similar costs, with Alternative 5 costing slightly less.

- ***Slag Pile Area (including Slope Stability):*** Alternative 4 is the most expensive Slag Pile Area alternative. Alternative 12 is the next most expensive, costing roughly one-half as much as Alternative 4. Alternatives 5 and 6 cost approximately the same amount, and are the least costly primary alternatives for the Slag Pile Area. The two add-on alternatives that address slope stability cost roughly the same amount.

OU2

- ***Main Industrial Area:*** Alternative 4 is the most expensive Main Industrial Area alternative, and Alternative 5 is the next most expensive alternative. Alternative 3 is the third most expensive alternative, costing less than one-half as much as Alternative 4. Alternative 2 is the least expensive alternative, costing less than one-half as much as Alternative 3.

- ***North Area:*** Alternative 5 is the most costly North Area alternative. Alternative 4 is the second most expensive alternative, costing just over one-half the cost of Alternative 5. Alternative 3 is the third most expensive alternative. The least expensive option is Alternative 2, which involves no active remediation measures.

- ***Building 100 Area:*** Alternative 4 is the most expensive Building 100 Area alternative. Alternative 3 is the next most expensive alternative, costing less than one-half as much as Alternative 4. The least expensive option is Alternative 2, which involves no active remediation measures. ,

- ***Rolling Mill Area:*** Alternative 4 is the most expensive Rolling Mill Area alternative. Alternatives 5 and 3 are the second and third most expensive alternatives, respectively. The least expensive option is Alternative 2, which involves no active remediation measures.

- ***Off-Site Residential Area:*** Alternative 4 is the most expensive Off-Site Residential Area alternative, and Alternative 2 is the second most expensive. Alternative 3 is the least expensive alternative. All three alternatives are estimated to cost $100 million or more because of the large number of residential properties that are estimated to require cleanup.

State Acceptance

The State of Illinois has reviewed both the FS and the Proposed Plan for the Site, and they support the preferred alternatives described in this Proposed Plan. EPA will further evaluate the State's position and key concerns on the preferred alternatives and other alternatives considered after the State's comments on the Proposed Plan are received.

Community Acceptance

For all areas of the Site, the local community's support of, reservations about, or opposition to components of the preferred alternatives and other alternatives considered will be evaluated after the public comment period ends and will be described in the Responsiveness Summary portion of the ROD.

EPA's PREFERRED ALTERNATIVES

EPA's preferred alternatives for the M&H Site, along with the rationale for choosing the preferred alternatives, are described below.

OU1 Preferred Alternatives

- ***Carus Plant Area:*** Alternative 6 – Soil Cover

- ***Slag Pile Area (including Slope Stability):*** Alternative 6 – Soil Cover, in conjunction with Alternative 15 – Sloping and Benching + Plantings + Revetments at the Toe of the Slope + BMPs

The preferred alternatives for OU1 were chosen over the other alternatives because they are expected to achieve long-term risk reduction through isolation of the soil contamination under a soil cover. The preferred alternatives will meet the RAOs within a reasonable time frame and at a reasonable cost and will allow the OU1 property to be used for the current and reasonably anticipated future land use, which is commercial/industrial. The preferred alternatives include the use of ICs and property access restrictions to ensure long-term effectiveness and permanence.

OU2 Preferred Alternatives

- ***Main Industrial Area:*** Alternative 2 – Soil Excavation + On-Site Consolidation under a Soil Cover

- ***North Area:*** Alternative 4 – Soil Excavation + On-Site Consolidation under a Soil Cover

- ***Building 100 Area:*** Alternative 3 – Soil Excavation + On-Site Consolidation under a Soil Cover

- ***Rolling Mill Area:*** Alternative 3 – Soil Excavation + On-Site Consolidation under a Soil Cover

- ***Off-Site Residential Area:*** Alternative 3 – Soil Excavation + On-Site Consolidation under a Soil Cover

The preferred alternatives for the OU2 soil areas were chosen over the other alternatives because they are expected to achieve long-term risk reduction through excavation and consolidation of the contaminated soils in an engineered, on-site consolidation area on the Main Industrial Area portion of the Site. The contaminated soils in the consolidation area would be isolated beneath a soil cover. The preferred alternatives will meet the RAOs within a reasonable time frame and at a reasonable cost. The preferred alternatives for the on-facility portions of OU2 will allow the property to be used for the current and reasonably anticipated future land use, which is commercial/industrial. The preferred alternative for the Off-Site Residential Area will allow that portion of the Site to be used for the current and reasonably anticipated future land use, which is residential. The preferred alternatives for the on-facility portions of OU2 include the use of ICs and property access restrictions to ensure long-term effectiveness and permanence. ICs would be needed for the Off-Site Residential Area only if contamination extends deeper than the maximum excavation depth of two feet.

Site-Wide Groundwater

As noted earlier, EPA is not proposing a remedy for groundwater at the Site. EPA believes that the exceedances of the State's Class II groundwater standards do not warrant CERCLA action. Although the risk assessment showed that there are unacceptable risks associated with the hypothetical ingestion of groundwater at the Site, the groundwater ingestion pathway is not a reasonably-anticipated exposure pathway. The groundwater at the Site is classified as non-potable groundwater, and institutional controls to prohibit the use of groundwater as a water supply are already in place. Illinois EPA may choose to establish a groundwater management zone at the Site pursuant to regulations in the Illinois Administrative Code related to groundwater quality (35 IAC, Subtitle F, Chapter I, Part 620), but this would not be part of EPA's proposed or selected remedy. EPA anticipates that the proposed remedial actions will serve to control the Site-related sources of the Class II groundwater exceedances, and that groundwater concentrations will decrease over time.

Although EPA is not proposing a groundwater remedial action, groundwater monitoring is included as part of the proposed remedy for the Site. The purpose of the groundwater monitoring is to evaluate the impact of the Site remedy on groundwater concentrations over time.

Summary

Based on the information currently available, EPA believes the preferred alternatives identified above meet the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. EPA expects the preferred alternatives to satisfy the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met. If the preferred alternatives identified in this Proposed Plan are selected as the final remedy for the Site, a review of the remedy's protectiveness would be required every five years since waste would be left on Site above levels that allow for unlimited use and unrestricted exposure.

Community Participation

EPA, in consultation with Illinois EPA, will evaluate public reaction to the preferred cleanup alternatives during the public comment period before deciding on final cleanup alternatives for the Site. Based on new information or public comments, EPA may modify its preferred alternatives or choose other alternatives. As such, EPA encourages the public to review and comment on all of the cleanup alternatives.

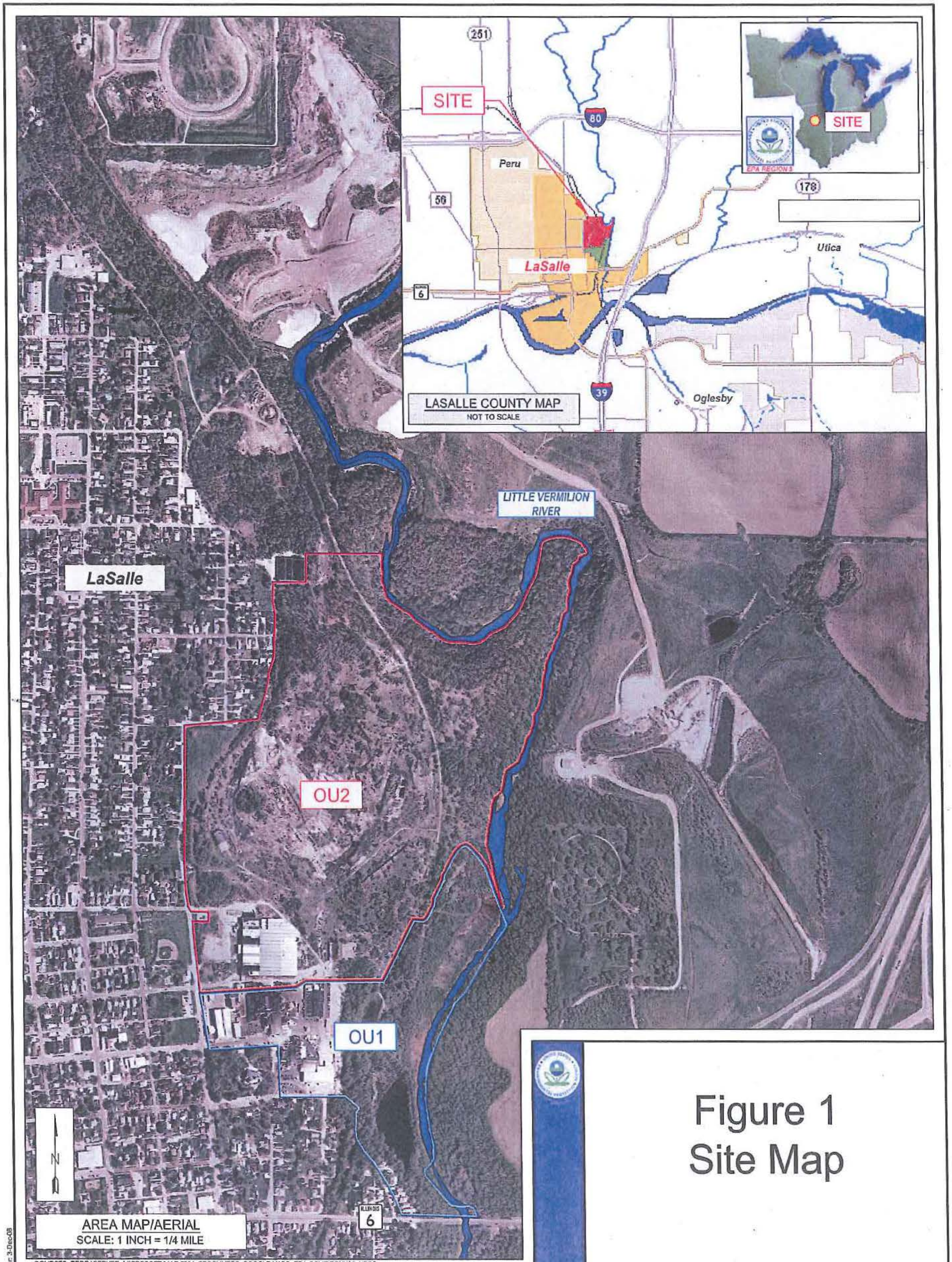
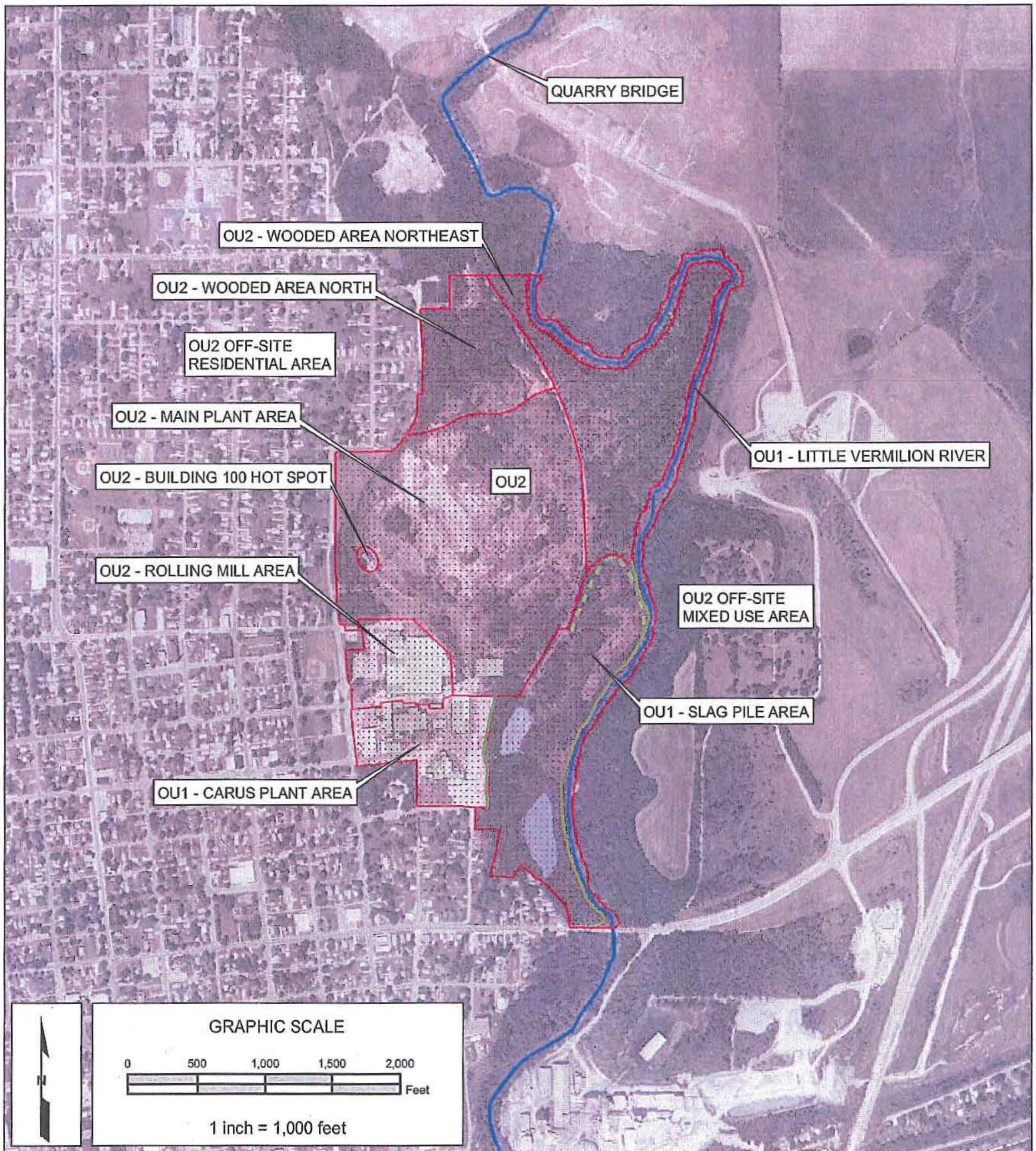


Figure 1
Site Map



OU Boundaries
Little Vermilion River
Approximate Northern Bounday of Slag Pile
Site Buildings
NPDES Non-Contact Cooling Water Ponds

Basemap Source:
USDA NAIP, 2007

Figure 2
Site Layout Map

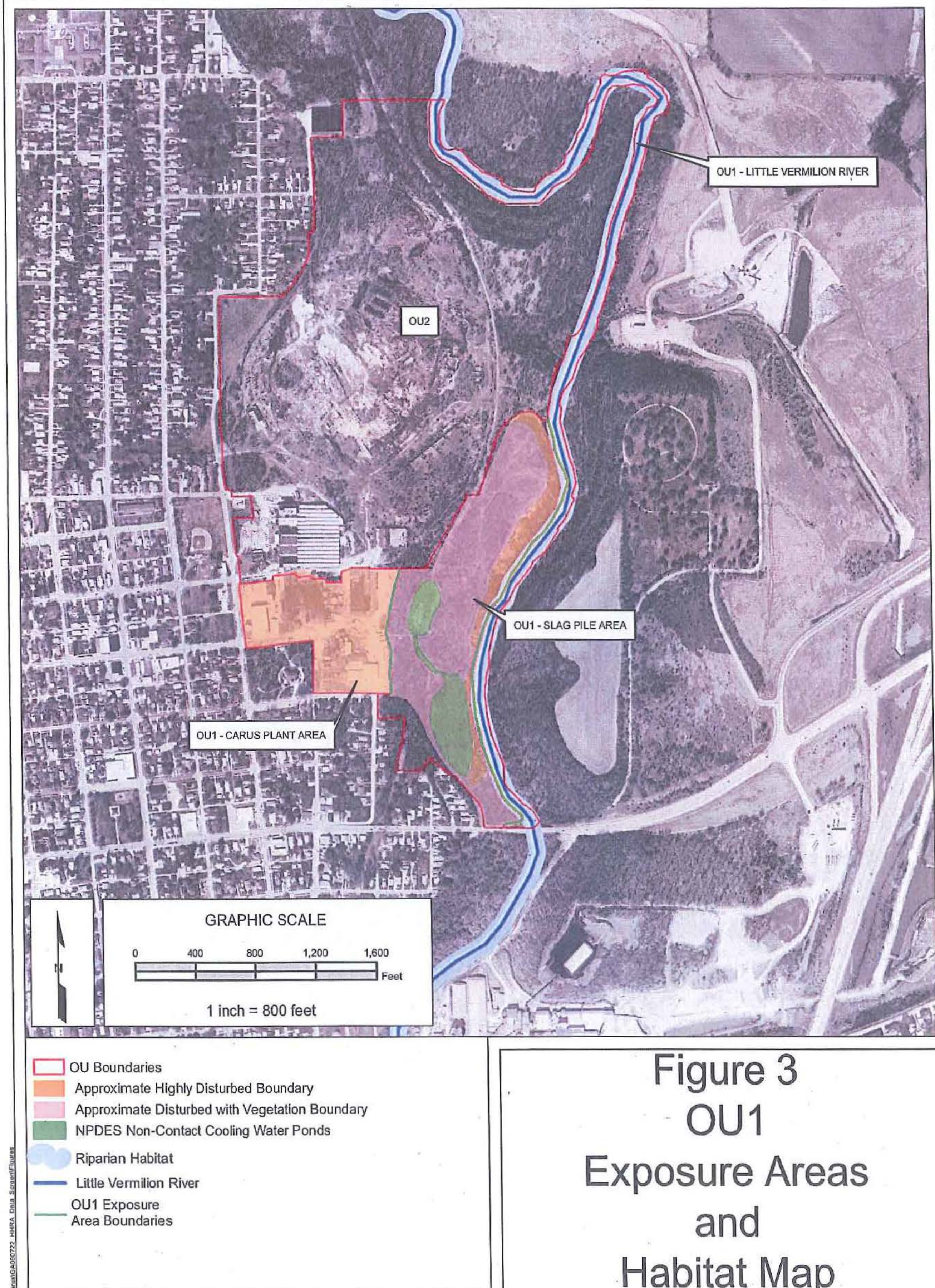


Figure 3
OU1
Exposure Areas
and
Habitat Map

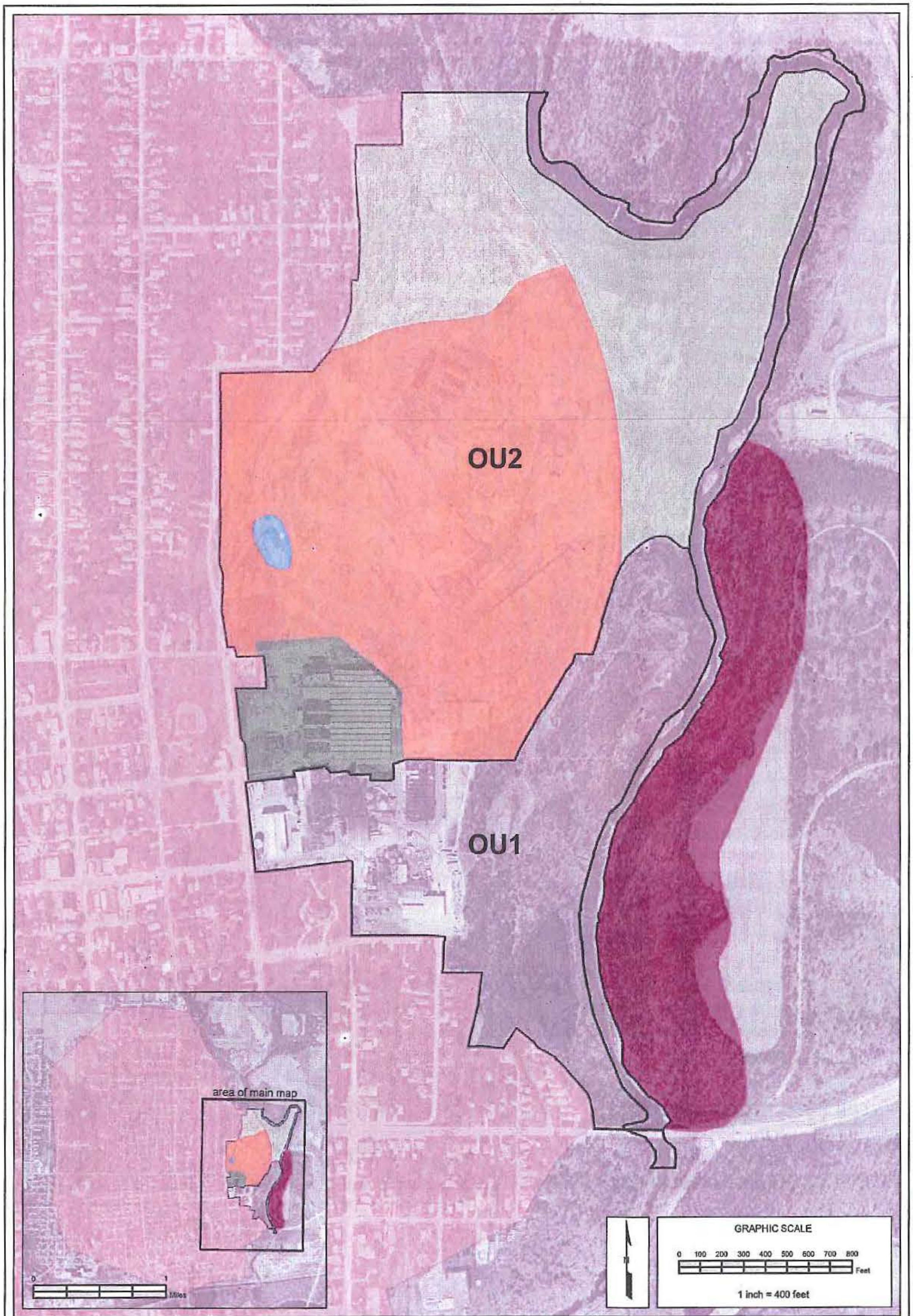


Figure 4
OU2
Exposure
Areas Map

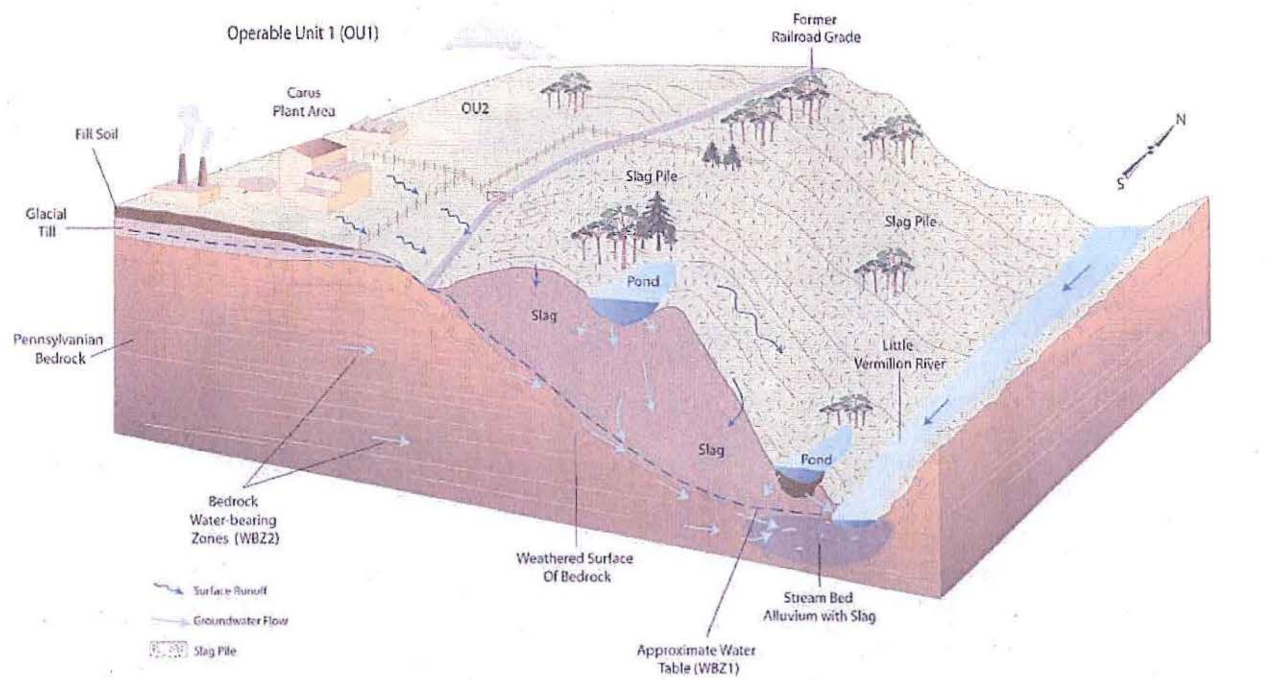


Figure 5
OU 1
Conceptual
Site Model

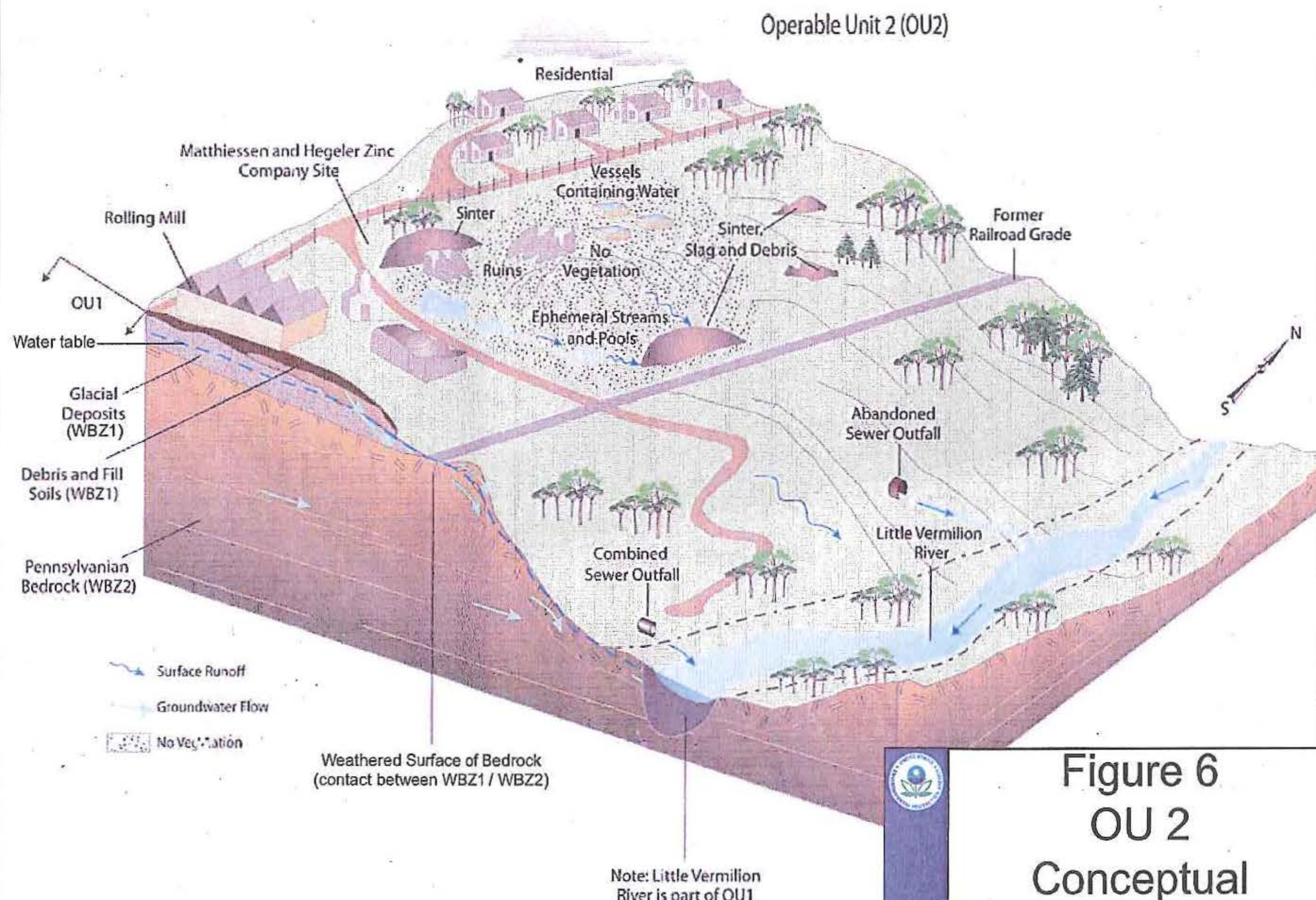


Figure 6
OU 2
Conceptual
Site Model

Main plant area - highly disturbed (little or no vegetation)

Adjacent to the main plant - disturbed with vegetation (woodland-grassland)

Savannah

Oak-hickory woodland

BERA = Baseline Ecological Risk Assessment

Figure 7
OU 2
Habitat
Map

Table 1
Contaminants of Concern for OU1

Exposure Area	Exposure Scenario	Exposure Medium	Chemical of Concern
OU1: PLANT AREA	CURRENT COMMERCIAL/ INDUSTRIAL WORKER	Surface Soil	Arsenic
			Chromium (5)
			Manganese
			Mercury (6)
			Aroclor 1254
			Aroclor 1260
			Benzo(a)pyrene
	FUTURE COMMERCIAL/ INDUSTRIAL WORKER	Subsurface Soil	Arsenic
			Chromium
			Manganese
			Aroclor 1254
			Aroclor 1260
			Benzo(a)pyrene
	CURRENT AND FUTURE UTILITY WORKER	Subsurface Soil	Arsenic
			Manganese
	FUTURE CONSTRUCTION WORKER	Subsurface Soil	Lead (7)
			Manganese
			Mercury (6)
	HYPOTHETICAL FUTURE RESIDENT	Surface Soil	Aluminum
			Antimony
			Arsenic
			Cadmium
			Chromium (5)
			Cobalt
			Copper
			Iron
			Lead (7)
			Manganese
			Mercury (6)
			Vanadium
			Zinc
			Aroclor 1254
			Aroclor 1260
			Benz(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Benzo(k)fluoranthene
			Dibenz(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
		Subsurface Soil	Aluminum
			Antimony
			Arsenic
			Cadmium
			Chromium (5)
			Cobalt
			Copper
			Iron
			Lead (7)
			Manganese
			Mercury (6)
			Vanadium
			Zinc
			Aroclor 1254
			Aroclor 1260
			Benz(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Benzo(k)fluoranthene
			Dibenz(a,h)anthracene
			Indeno(1,2,3-cd)pyrene

Exposure Area	Exposure Scenario	Exposure Medium	Chemical of Concern
OU1: SLAG PILE AREA	FUTURE COMMERCIAL/ INDUSTRIAL WORKER	Surface Soil	Arsenic
			Cobalt
			Lead (7)
			Manganese
			Mercury (6)
			Zinc
			Hexachlorobenzene
		Subsurface Soil	Arsenic
			Cobalt
			Lead (7)
			Manganese
			Mercury (6)
			Zinc
			Benzo(a)pyrene
			Hexachlorobenzene
	CURRENT AND FUTURE SITE-SPECIFIC WORKER	Surface Soil	Arsenic
			Hexachlorobenzene
		Subsurface Soil	Arsenic
			Hexachlorobenzene
	CURRENT AND FUTURE UTILITY WORKER	Subsurface Soil	Arsenic
			Lead (7)
			Manganese
			Hexachlorobenzene
	FUTURE CONSTRUCTION WORKER	Subsurface Soil	Aluminum
			Antimony
			Arsenic
			Barium
			Cadmium
			Cobalt
			Copper
			Iron
			Lead (7)
			Manganese
			Mercury (6)
			Vanadium
			Zinc
	CURRENT TRESPASSER - ADOLESCENT	Surface Soil	***None***
	CURRENT TRESPASSER - ADULT	Surface Soil	Arsenic
	FUTURE RECREATIONALIST - CHILD	Subsurface Soil	Arsenic
			Lead (7)
	FUTURE RECREATIONALIST - ADOLESCENT	Subsurface Soil	***None***
	FUTURE RECREATIONALIST - ADULT	Subsurface Soil	Arsenic

Notes:

1. Risk-Based Remedial Action Level (RAL) is the minimum of the cancer (CA) and non-cancer (NC) RAL, calculated as follows:

a) RAL_{CA} = EPC x (TCR / Calculated Risk)

b) RAL_{NC} = EPC x (THQ / Calculated HQ)

where:

EPC = Exposure Point Concentration

TCR = Target Cancer Risk

THQ = Target Hazard Quotient

HQ = Hazard Quotient

c) Or, for lead, the RAL is the receptor-specific preliminary remediation goals (PRGs) calculated in Appendix RA-4 of the RI Report using the Integrated Exposure Uptake Biokinetic (IEUBK) Model or the Adult Lead Model (ALM).

2. Laboratory practical quantitation limit (PQL) IS TBD.

3. Site-specific background threshold value (BTV) developed as described in Appendix RA-2 of the RI.

4. Human Health RAL is selected as the maximum of the BTV, PQL, or risk-based RAL.

5. BTV, PQL, and risk-based RAL are for total chromium concentrations. In the HHRA, total chromium was evaluated assuming a 1:6 hexavalent-to-trivalent ratio and utilizing the species-specific toxicity values. Only hexavalent chromium was identified as a COC. The total chromium risk-based RAL presented in the table was calculated by multiplying the hexavalent chromium risk-based RAL by 7.

6. In the HHRA, mercury was evaluated assuming the most toxic form for a given exposure pathway. Toxicity values for inorganic mercury species were used to evaluate ingestion and dermal contact pathways where as toxicity values for elemental mercury were used to evaluate inhalation pathways. This approach inherently assumes that mercury is simultaneously present in both forms and, therefore, overestimates risk. Thus, the RALs are also conservatively biased.

Table 1
Contaminants of Concern for OU2

Investigation Area	Exposure Area	Exposure Medium	Chemical of Concern
IA 3- Former Main Industrial (MIA) Area	Main Plant Area	Surface Soil	Antimony
			Aroclor-1248
			Aroclor-1260
			Arsenic
			Asbestos
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Cadmium
			Chromium, hexavalent
			Cobalt
			Dibenzo(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
			Lead
			Manganese
			Mercury
			Thallium
			Zinc
		Subsurface Soil	Antimony
			Aroclor-1248
			Aroclor-1260
			Arsenic
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Cadmium
			Chromium, hexavalent
			Cobalt
			Dibenzo(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
			Lead
			Manganese
			Mercury
			Thallium
			Zinc

Table 1
Contaminants of Concern for OU2

Investigation Area	Exposure Area	Exposure Medium	Chemical of Concern
IA 4 - North (N) Area	Wooded Area North	Surface Soil	Antimony
			Arsenic
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Cadmium
			Chromium, hexavalent
			Copper
			Lead
			Manganese
			Zinc
		Subsurface Soil	Antimony
			Arsenic
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Cadmium
			Chromium, hexavalent
			Copper
			Manganese
			Zinc
IA 1 - Building 100 (B100) Area	Building 100	Surface Soil	Aroclor-1260
			Arsenic
			Asbestos
			Benzo(a)pyrene
			Dibenzo(a,h)anthracene
			Lead
			Manganese
			Thallium
		Subsurface Soil	Aroclor-1260
			Arsenic
			Benzo(a)pyrene
			Dibenzo(a,h)anthracene
			Lead
			Manganese
			Thallium

Table 1
Contaminants of Concern for OU2

Investigation Area	Exposure Area	Exposure Medium	Chemical of Concern
IA 2 - Rolling Mill (RM) Area	Rolling Mill Area	Surface Soil	Aroclor-1248
			Arsenic
			Asbestos
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Copper
			Cyanide
			Dibenzo(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
			Lead
			Trichloroethene
			Zinc
		Subsurface Soil	Aroclor-1248
			Arsenic
			Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Copper
			Cyanide
			Dibenzo(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
			Lead
			Trichloroethene
			Zinc
IA 5 - Residential (RES) Area	Off-Site Residential Area	Surface Soil	Arsenic
			Cadmium
			Chromium, hexavalent
			Lead
			Manganese
			Zinc
		Subsurface Soil	Arsenic
			Lead

Notes

1. Surface soil represents 0-2 ft bgs interval. Subsurface soil represents 2-10 ft bgs interval.

2. PQL is based on Contract Laboratory Program's (CLP) Contract Required Quantitation Limits (CRQL) except for Hexavalent Chromium, which is based on SW-846 Method 7196.

Table 1
Contaminants of Concern for OU2

Exposure Area	Exposure Medium	Chemical of Concern
Main Plant Area	Groundwater	Trichloroethene
		Vinyl chloride
Wooded Area North	Groundwater	Chloroform
		Naphthalene
Building 100 Hot Spot	Groundwater	*None*
Rolling Mill Area	Groundwater	Trichloroethene
Exposure Area	**Exposure Medium**	**Chemical of Concern**
OU2-wide (All Exposure Areas) [4]	Groundwater	Cadmium
		Cobalt
		Iron
		Lead
		Manganese
		Selenium
		Zinc

Notes
1. Groundwater RALs are based on non-potable groundwater uses only.
2. No ecological risks are included for groundwater.
3. Groundwater RALs apply to all of OU2 groundwater.
4. All Exposure Areas does not include Residential Area
5. No inorganic constituents exceeded risk of 1E-06

Table 2

Proposed Plan
Matthiessen and Hegeler Zinc Company
Site
LaSalle, Illinois
Soil Preliminary Remediation Goal Summary
April 2015

Contaminant of Concern	On Site Soil	
	PRG[1] (mg/kg)	Basis
Antimony	118.8	RBC
Arochlor-1248	4.2	RBC
Arochlor-1260	4.2	RBC
Arsenic	37.0	RBC
Asbestos[3]	TBD	TBD
Benzo(a)anthracene	21.1	RBC
Benzo(a)pyrene	2.1	RBC
Benzo(b)fluoranthene	21.1	RBC
Cadmium	263.9	RBC
Chromium (hexavalent)[4]	214.9	RBC
Cobalt	88.6	RBC
Copper	11879	RBC
Cyanide	3.0	RBC
Dibenzo(a,h)anthracene	2.1	RBC
Indeno(1,2,3-cd)pyrene	21.1	RBC
Lead	800.0	RSL
Manganese	6778	RBC
Mercury	4.8	RBC
Thallium	3.2	BTV
Trichloroethene	3.2	RBC
Zinc	89091	RBC

Contaminant of Concern	Off Site Soil (Residential Area)	
	PRG[2] (mg/kg)	Basis
Arsenic	18.0	RBC
Cadmium	6.4	RBC
Chromium (hexavalent)[4]	1.0	PQL
Lead	400.0	RSL
Manganese	1056	BTV
Zinc	1379	RBC

Notes:
mg/kg milligram per kilogram
BTV Background Threshold Value
PRG Preliminary Remediation Goal
PQL Practical Quantitation Limit
RBC Risk-Based Concentration
RSL EPA Regional Screening Level (400 for Residential Soil, 800 for Commercial/Industrial Soil)
TBD To Be Determined

[1] On site commercial/industrial PRGs are based on the lower of 1E-05 or HI = 1 for the most conservative exposure scenario evaluated in the risk assessment.

[2] Off site residential PRGs are based on the lower of 1E-06 or HI = 1 for the most conservative exposure scenario evaluated in the risk assessment (except for aresenic which is based on the lower of 1E-04 or HI = 1).

[3] The PRG for asbestos was assumed to be 1% in soil in the FS report. Additional investigation is needed during the remedial design to determine the final PRG for asbestos.

[4] The risk assessment and FS report assumed that hexavalent chromium was present as a percentage of total chromium. Additional investigation is needed during the remedial design phase to determine if hexavalent chromium is present and should be retained as a COC.

Table 3 – Summary of Remedial Alternatives

Media - Area	Alternative	THRESHOLD CRITERIA [1]		PRIMARY BALANCING CRITERIA [2]					MODIFYING CRITERIA [3]		CERCLA	CERCLA	OTHER CRITERIA [2,4]
		Overall protectiveness of human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, or volume through treatment	Short-term effectiveness	Implementability	Cost (relative to other alternatives)	State acceptance	Community acceptance	Criteria - Alternative Total Score	Criteria - Alternative Rank	Sustainability [5]
OU1 Plant Area	Alt 1 - No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	4	NA
	Alt 4 - Excavation + IC + Property Access Restrict	Pass	Pass	5	2	2	3	2	NA	NA	14	2	12
	Alt 5 - Low Perm Cap + IC + Property Access Restrict	Pass	Pass	4	2	3	4	5	NA	NA	18	1	16
	Alt 6 - Soil Cover + IC + Property Access Restrict	Pass	Pass	2	1	3	4	2	NA	NA	12	3	15
OU1 Slag Pile Area	Alt 1 - No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	7	NA
	Alt 4 - Excavation + Off-Site Disposal + IC + Property Access Restrict	Pass	Pass	5	2	2	2	1	NA	NA	12	6	12
	Alt 12 - Excavation + On-Site Consolidation (OU2) + IC + Property Access Restrict	Pass	Pass	5	2	2	2	2	NA	NA	13	5	15
	Alt 5 - Low Perm Cap + IC + Property Access Restrict	Pass	Pass	2	2	3	3	5	NA	NA	15	3	18
	Alt 6 - Soil Cover + IC + Property Access Restrict	Pass	Pass	2	1	3	3	5	NA	NA	14	4	17
	Alt 14 - Sloping and Benching + Revetments + BMPs	Pass	Pass	3	2	4	3	4	NA	NA	16	2	18
	Alt 15 - Sloping and Benching + Plantings + Revetments + BMPs	Pass	Pass	4	2	4	3	4	NA	NA	17	1	19

Table 3 – Summary of Remedial Alternatives

Media - Area	Alternative	THRESHOLD CRITERIA[1]: Overall protection of human health and the environment	THRESHOLD CRITERIA[1]: Compliance with ARARs	PRIMARY BALANCING CRITERIA[2]: Long-term effectiveness and permanence	PRIMARY BALANCING CRITERIA[2]: Reduction of toxicity, mobility, or volume through treatment	PRIMARY BALANCING CRITERIA[2]: Short-term effectiveness	PRIMARY BALANCING CRITERIA[2]: Implementability	PRIMARY BALANCING CRITERIA[2]: Cost (relative to other alternatives)	MODIFYING CRITERIA[3]: State acceptance	MODIFYING CRITERIA[3]: Community acceptance	CERCLA Criteria Alternative Total Score	CERCLA Criteria Alternative Rank	OTHER CRITERIA[4]: Sustainability[5]
OU2 Soil - B100 Area	Alternative 1 No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	NA	Highly sustainable
	Alternative 2 Institutional Controls Only	Pass	Pass	2	1	5	4	3	NA	NA	15	2	Highly sustainable
	Alternative 3 Soil Excavation + On-Site Consolidation under Soil Cover	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Moderately sustainable
	Alternative 4 Soil Excavation + Off-Site Disposal	Pass	Pass	5	2	2	5	1	NA	NA	15	3	Somewhat sustainable
OU2 Soil - RM Area	Alternative 1 No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	NA	Highly sustainable
	Alternative 2 Institutional Controls Only	Pass	Pass	2	1	5	4	4	NA	NA	16	3	Highly sustainable
	Alternative 3 Soil Excavation + On-Site Consolidation under Soil Cover	Pass	Pass	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Moderately sustainable
	Alternative 4 Soil Excavation + *Ex-Situ* Treatment by Soil Washing	Pass	Pass	3	4	3	3	1	NA	NA	14	4	Somewhat sustainable
	Alternative 5 Soil Excavation + Off-Site Disposal	Pass	Pass	5	2	2	5	2	NA	NA	16	2	Somewhat sustainable
OU2 Soil - MIA Area	Alternative 1 No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	NA	Highly sustainable
	Alternative 2 Soil Excavation + On-Site Consolidation under Soil Cover + Institutional Controls	Pass	Pass	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	[illegible]	[illegible]	Moderately sustainable
	Alternative 3 *Ex-Situ* Chemical Stabilization	Pass	Pass	2	2	3	4	3	NA	NA	14	4	Somewhat sustainable
	Alternative 4 Soil Excavation + *Ex-Situ* Treatment by Soil Washing	Pass	Pass	3	4	3	3	1	NA	NA	14	3	Somewhat sustainable
	Alternative 5 Soil Excavation + Off-Site Disposal	Pass	Pass	5	2	2	5	2	NA	NA	16	2	Somewhat sustainable
OU2 Soil - N Area	Alternative 1 No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	NA	Highly sustainable
	Alternative 2 Institutional Controls Only	Pass	Pass	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	[illegible]	[illegible]	Highly sustainable
	Alternative 3 Phytoremediation + Institutional Controls	Pass	Pass	3	3	4	3	3	NA	NA	16	2	Moderately sustainable
	Alternative 4 Soil Excavation + On-Site Consolidation under Soil Cover	Pass	Pass	5	2	2	4	2	NA	NA	15	3	Moderately sustainable
	Alternative 5 Soil Excavation + Off-Site Disposal	Pass	Pass	5	2	1	5	1	NA	NA	14	4	Somewhat sustainable
OU2 Soil - RES Area	Alternative 1 No Action	Fail	Fail	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Alternative 2 On-Site Soil Cover + Institutional Controls	Pass	Pass	2	2	2	2	2	NA	NA	10	3	Somewhat sustainable
	Alternative 3 Soil Excavation + On-Site Consolidation under Soil Cover	Pass	Pass	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	[illegible]	[illegible]	Moderately sustainable
	Alternative 4 Soil Excavation + Off-Site Disposal	Pass	Pass	3	2	2	3	1	NA	NA	13	2	Somewhat sustainable

Notes:
Dark grey highlighting indicates a ranking of 1 for all compared alternatives within each medium/area

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteri
2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of these scales for each criterion are listed below

Long-term effectiveness and permanence
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment)
- 1 = Detrimental impacts during implementation
- 2 = Significant impacts during implementation
- 3 = Minimal impacts during implementation
- 4 = Slight impact during implementation
- 5 = No impacts during implementation

Implementability
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives)
- Ranked by sustainability evaluations presented in Section

3 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS Report and the Proposed Plan, and will be addressed in the ROD
4 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness
5 The sustainability score development is presented in Table 4.3.3-3, evaluated on a scale of 1-25, with sustainability score range definitions below

Sustainability Criterion Score (relative to other alternatives)
- Ranked by sustainability evaluations presented in Section
- 1-5 = Not sustainable
- 6-10 = Potentially sustainable
- 11-15 = Somewhat sustainable
- 16-20 = Moderately sustainable
- 21-25 = Highly sustainable

OU1 SUMMARY OF REMEDIAL ALTERNATIVES COMPARATIVE EVALUATION
MATTHIESSEN AND HEGELER ZINC COMPANY SITE

Notes:

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criteria are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of the scales for each criteria are listed below:

Long-term effectiveness and permanence:
- 1 = In-effective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment):
- 1 = Detrimental impacts during implementation
- 2 = Significant impacts during implementation
- 3 = Minimal impacts during implementation
- 4 = Slight impact during implementation
- 5 = No impacts during implementation

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

3 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

4 The Other Criterion, sustainability, is not required by the CERCLA 1988 RI/FS guidance but it has been included for completeness.

5 The Sustainability score development is presented in Tables 4.2.1-4 and 4.2.2-4. Sustainability scores range from 5 to 25.

Table 4 – Detailed Comparative Analysis

OU1 – Plant Area

Evaluation Criteria	OU1 Plant Area Remedial Alternatives[1]			
	Alt 1 - No Action	Alt 4 - Excavation + IC + Property Access Restrict	Alt 5 - Low Perm Cap + IC + Property Access Restrict	Alt 6 - Soil Cover + IC + Property Access Restrict
THRESHOLD CRITERIA[2]				
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA[3]				
Long-term effectiveness and permanence	NA	Highly effective and permanent	Highly effective	Somewhat effective
Criterion Score		5	4	2
Reduction of toxicity (T), mobility (M), or volume (V) through treatment	NA	No treatment; contaminant M reduced through offsite disposal	No treatment; contaminant exposure and M reduced through capping	No treatment; contaminant exposure reduced by soil cover
Criterion Score		2	2	1
Short-term effectiveness	NA	Moderate impacts during implementation	Minimal impacts during implementation	Minimal impacts during implementation
Criterion Score		2	3	3
Implementability	NA	Implementable, but challenging excavation areas	Easily implementable	Easily implementable
Criterion Score		3	4	4
Cost (relative to other alternatives)[4]	NA	$4.14 M / $5.95 M / $6.39 M	$1.30 M / $1.53 M / $1.57 M	$1.43 M / $1.62 M / $1.67 M
Criterion Score		1	5	4
MODIFYING CRITERIA[5]				
CERCLA Criteria - Alternative Total Score	NA	13	18	14
CERCLA Criteria - Alternative Rank	4	3	1	2
OTHER CRITERIA[3,6]				
Sustainability[7]	NA	12	16	15
Sustainability - Alternative Rank	4	3	1	2

Notes:

1 OU1 Plant Area Alternatives 2, 3, 7, 8, and 9 were not carried forward after the initial alternative screening process (see Section 3 of FS).

2 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criteria are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

3 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of the scales for each criteria are listed below:

Long-term effectiveness and permanence:
- 1 = In-effective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment):
- 1 = Detrimental impacts during implementation
- 2 = Significant impacts during implementation
- 3 = Minimal impacts during implementation
- 4 = Slight impact during implementation
- 5 = No impacts during implementation

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

4 Cost is present in millions of dollars. A full presentation of alternative costs can be found in Section 4 of the FS.

5 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

6 The Other Criterion, sustainability, is not required by the CERCLA 1988 RI/FS guidance but it has been included for completeness.

7 The Sustainability score development is presented in Table 4.2.1-4. Sustainability scores range from 5 to 25.

Table 4 – Detailed Comparative Analysis
OU1 – Slag Pile

Evaluation Criteria	OU1 Slag Pile Area Remedial Alternatives[1]						
	Alt 1 - No Action	Alt 4 - Excavation + Off-Site Disposal + IC + Property Access Restrict	Alt 12 - Excavation + On-Site Consolidation (OU1) + IC + Property Access Restrict	Alt 5 - Low Perm Cap + IC + Property Access Restrict	Alt 6 - Soil Cover + IC + Property Access Restrict	Alt 14 - Sloping and Benching + Revetments + BMPs	Alt 15 - Sloping and Benching + Plantings + Revetments + BMPs
THRESHOLD CRITERIA[2]							
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA[3]							
Long-term effectiveness and permanence	NA	Highly effective and permanent	Highly effective and permanent	Somewhat effective	Somewhat effective	Effective and permanent	Highly effective and permanent
Criterion Score		5	5	2	2	3	4
Reduction of toxicity (T), mobility (M), or volume (V) through treatment	NA	No treatment; onsite T, M, and V reduced through offsite disposal	No treatment; onsite T, M, and V reduced through offsite disposal	No treatment; contaminant T and M reduced through capping	No treatment; contaminant T reduced by soil cover	No treatment; contaminant M reduced through erosion controls	No treatment; contaminant M reduced through erosion controls
Criterion Score		2	2	2	1	2	2
Short-term effectiveness	NA	Moderate impacts during implementation	Moderate impacts during implementation	Minimal impacts during implementation	Minimal impacts during implementation	Slight impact during implementation	Slight impact during implementation
Criterion Score		2	2	3	3	4	4
Implementability	NA	Difficult to implement	Difficult to implement	Implementable, but challenging working on steep slopes	Implementable, but challenging working on steep slopes	Implementable, but challenging benching areas on slopes	Implementable, but challenging benching areas on slopes
Criterion Score		2	2	3	3	3	3
Cost (relative to other alternatives)[4]	NA	$214.1 M	$101.6 M	$5.28 M / $7.31 M / $7.31 M	$5.15 M / $7.09 M / $7.09 M	$17.99 M / $18.25 M	$18.12 M / $18.42 M
Criterion Score		1	2	5	5	4	4
MODIFYING CRITERIA[5]							
CERCLA Criteria - Alternative Total Score	NA	12	13	15	14	16	17
CERCLA Criteria - Alternative Rank	7	6	5	3	4	2	1
OTHER CRITERIA[5,6]							
Sustainability[7]	NA	12	15	18	17	18	19
Sustainability - Alternative Rank	7	6	5	2	4	2	1

Notes:

1 OU1 Slag Pile Area Alternatives 2, 3, 7, 8, 9, 10, 11, and 13 were not carried forward after the initial alternative screening process (see Section 3 of FS).

2 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criteria are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

3 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of the scales for each criteria are listed below:

Long-term effectiveness and permanence:
- 1 = In-effective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment):
- 1 = Detrimental impacts during implementation
- 2 = Significant impacts during implementation
- 3 = Minimal impacts during implementation
- 4 = Slight impact during implementation
- 5 = No impacts during implementation

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

4 Cost is present in millions of dollars. A full presentation of alternative costs can be found in Section 4 of the FS.

5 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

6 The Other Criterion, sustainability, is not required by the CERCLA 1988 RI/FS guidance but it has been included for completeness.

7 The Sustainability score development is presented in Table 4.2.2-4. Sustainability scores range from 5 to 25.

Table 4 – Detailed Comparative Analysis
OU2 – MIA

Evaluation Criteria	OU2 Soil MIA Area Remedial Alternatives				
	Alternative 1 No Action	Alternative 2 Soil Excavation + On-Site Consolidation under Soil Cover + Institutional Controls	Alternative 3 *Ex Situ* Chemical Stabilization	Alternative 4 Soil Excavation + *Ex Situ* Treatment by Soil Washing	Alternative 5 Soil Excavation + Off-Site Disposal
THRESHOLD CRITERIA [1]					
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA [2]					
Long-term effectiveness and permanence	NA	Highly effective	Somewhat effective	Effective	Highly effective and permanent
Criteria Score		4	2	3	5
Reduction of toxicity, mobility, or volume through treatment	NA	Somewhat effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume	Highly effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume
Criteria Score		2	2	4	2
Short-term effectiveness	NA	Minimal impacts during implementation	Minimal impacts during implementation	Minimal impacts during implementation	Significant impacts during implementation
Criteria Score		3	3	3	2
Implementability	NA	Readily implementable	Readily implementable	Implementable	Easily implementable
Criteria Score		4	4	3	5
Cost (relative to other alternatives) [3]	NA	\$32.7M/ \$33.6M/ \$34.9M	\$70.4M/ \$72.6M/ \$80.4M	\$177M/ \$182M/ \$204M	\$120M/ \$124M/ \$137M
Criteria Score		4	3	1	2
MODIFYING CRITERIA [4]					
CERCLA Criteria - Alternative Total Score	NA	17	14	14	16
CERCLA Criteria - Alternative Rank		1	4	3	2
OTHER CRITERIA [2,5]					
Sustainability [6]	Highly sustainable	Moderately sustainable	Somewhat sustainable	Somewhat sustainable	Somewhat sustainable

Notes:

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of these scales for each criterion are listed below:

Long-term effectiveness and permanence:
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

Short-term effectiveness (impact to community, site workers, and environment):

1 = Detrimental impacts during implementation
2 = Significant impacts during implementation
3 = Minimal impacts during implementation
4 = Slight impact during implementation
5 = No impacts during implementation

3 Cost is present in millions of dollars. Three risk levels of cost are presented as E1-04/E1-05/E1-06. A full presentation of alternative costs can be found in Section 4 of the FS.

4 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

5 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness.

6 The sustainability score development is presented in Table 4.3.3-3, evaluated on a scale of 1-25, with sustainability score range definitions below.

Sustainability Criterion Score (relative to other alternatives):

- Ranked by sustainability evaluations presented in Section 4

1-5 = Not sustainable
6-10 = Potentially sustainable
11-15 = Somewhat sustainable
16-20 = Moderately sustainable
21-25 = Highly sustainable

Table 4 – Detailed Comparative Analysis

OU2 – N Area

Evaluation Criteria	OU2 Soil N Area Remedial Alternatives				
	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Phytoremediation + Institutional Controls	Alternative 4 Soil Excavation + On-Site Consolidation under Soil Cover	Alternative 5 Soil Excavation + Off-Site Disposal
THRESHOLD CRITERIA [1]					
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA [2]					
Long-term effectiveness and permanence	NA	Somewhat effective	Effective	Highly effective and permanent	Highly effective and permanent
Criteria Score		2	3	5	5
Reduction of toxicity, mobility, or volume through treatment	NA	Does not reduce toxicity, mobility, or volume	Effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume
Criteria Score		1	3	2	2
Short-term effectiveness	NA	No impacts during implementation	Slight impacts during implementation	Significant impacts during implementation	Detrimental impacts during implementation
Criteria Score		5	4	2	1
Implementability	NA	Readily implementable	Implementable	Readily implementable	Easily implementable
Criteria Score		4	3	4	5
Cost (relative to other alternatives) [3]	NA	$0.28M/ $0.28M/ $0.28M	$11.0M/ $12.1M/ $13.3M	$6.7M/ $14.9M/ $19.6M	$15.5M/ $34.8M/ $45.9M
Criteria Score		4	3	2	1
MODIFYING CRITERIA [4]					
CERCLA Criteria - Alternative Total Score	NA	16	16	15	14
CERCLA Criteria - Alternative Rank	NA	1	2	3	4
OTHER CRITERIA [2,5]					
Sustainability [6]	Highly sustainable	Highly sustainable	Moderately sustainable	Moderately sustainable	Somewhat sustainable

Notes:

1. The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.
2. The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of these scales for each criterion are listed below:

Long-term effectiveness and permanence:
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Short-term effectiveness (impact to community, site workers, and environment):

1 = Detrimental impacts during implementation

2 = Significant impacts during implementation

3 = Minimal impacts during implementation

4 = Slight impact during implementation

5 = No impacts during implementation

3 Cost is present in millions of dollars. Three risk levels of cost are presented as E1-04/E1-05/E1-06. A full presentation of alternative costs can be found in Section 4 of the FS.

4 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

5 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness.

6 The sustainability score development is presented in Table 4.3.4-3, evaluated on a scale of 1-25, with sustainability score range definitions below.

Sustainability Criterion Score:

- Ranked by sustainability evaluations presented in Section 4

1-5 = Not sustainable

6-10 = Potentially sustainable

11-15 = Somewhat sustainable

16-20 = Moderately sustainable

21-25 = Highly sustainable

Table 4 – Detailed Comparative Analysis

OU2 – B100

Evaluation Criteria	OU2 Soil B100 Area Remedial Alternatives			
	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Soil Excavation + On-site Consolidation under Soil Cover	Alternative 4 Soil Excavation + Off-Site Disposal
THRESHOLD CRITERIA [1]				
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA [2]				
Long-term effectiveness and permanence	NA	Somewhat effective	Highly effective and permanent	Highly effective and permanent
Criteria Score		2	5	5
Reduction of toxicity, mobility, or volume through treatment	NA	Does not reduce toxicity, mobility, or volume	Somewhat effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume
Criteria Score		1	2	2
Short-term effectiveness	NA	No impacts during implementation	Minimal impacts during implementation	Significant impacts during implementation
Criteria Score		5	3	2
Implementability	NA	Readily implementable	Readily implementable	Easily implementable
Criteria Score		4	4	5
Cost (relative to other alternatives) [3]	NA	\$0.43M/ \$0.43M/ \$0.43M	\$3.1M/ \$3.2M/ \$4.0M	\$8.8M/ \$9.2M/ \$12.0M
Criteria Score		3	2	1
MODIFYING CRITERIA [4]				
CERCLA Criteria - Alternative Total Score	NA	15	16	15
CERCLA Criteria - Alternative Rank		2	1	3
OTHER CRITERIA [2,5]				
Sustainability [6]	Highly sustainable	Highly sustainable	Moderately sustainable	Somewhat sustainable

Notes:

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of these scales for each criterion are listed below:

Long-term effectiveness and permanence:
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Reduction of toxicity, mobility, or volume through treatment:
1 = Does not reduce toxicity, mobility, or volume
2 = Somewhat effective at reducing toxicity, mobility, and/or volume
3 = Effective at reducing toxicity, mobility, and/or volume
4 = Highly effective at reducing toxicity, mobility, and/or volume
5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment):
1 = Detrimental impacts during implementation
2 = Significant impacts during implementation
3 = Minimal impacts during implementation
4 = Slight impact during implementation
5 = No impacts during implementation

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

3 Cost is present in millions of dollars. Three risk levels of cost are presented as 1E-04/1E-05/1E-06. A full presentation of alternative costs can be found in Section 4 of the FS.
4 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.
5 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness.
6 The sustainability score development is presented in Table 4.3.1-3, evaluated on a scale of 1-25, with sustainability score range definitions below.

Sustainability Criterion Score (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4
1-5 = Not sustainable
6-10 = Potentially sustainable
11-15 = Somewhat sustainable
16-20 = Moderately sustainable
21-25 = Highly sustainable

Table 4 – Detailed Comparative Analysis
OU2 – RM

Evaluation Criteria	OU2 Soil RM Area Remedial Alternatives				
	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Soil Excavation + On-site Consolidation under Soil Cover	Alternative 4 Soil Excavation + *Ex-Situ* Treatment by Soil Washing	Alternative 5 Soil Excavation + Off-Site Disposal
THRESHOLD CRITERIA [1]					
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA [2]					
Long-term effectiveness and permanence	NA	Somewhat effective	Highly effective and permanent	Effective	Highly effective and permanent
Criteria Score		2	5	3	5
Reduction of toxicity, mobility, or volume through treatment	NA	Does not reduce toxicity, mobility, or volume	Somewhat effective at reducing toxicity, mobility, and/or volume	Highly effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume
Criteria Score		1	2	4	2
Short-term effectiveness	NA	No impacts during implementation	Minimal impacts during implementation	Minimal impacts during implementation	Significant impacts during implementation
Criteria Score		5	3	3	2
Implementability	NA	Readily implementable	Readily implementable	Implementable	Easily implementable
Criteria Score		4	4	3	5 *
Cost (relative to other alternatives) [3]	NA	$0.47M/ $0.47M/ $0.47M	$3.2M/ $3.6M/ $4.5M	$8.9M/ $10.0M/ $13.8M	$6.3M/ $7.3M/ $9.6M
Criteria Score		4	3	1	2
MODIFYING CRITERIA [4]					
CERCLA Criteria - Alternative Total Score	NA	16	17	14	16
CERCLA Criteria - Alternative Rank	-	3	1	4	2
OTHER CRITERIA [2,5]					
Sustainability [6]	Highly sustainable	Highly sustainable	Moderately sustainable	Somewhat sustainable	Somewhat sustainable

Notes:

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of these scales for each criterion are listed below:

Long-term effectiveness and permanence:
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Reduction of toxicity, mobility, or volume through treatment:
- 1 = Does not reduce toxicity, mobility, or volume
- 2 = Somewhat effective at reducing toxicity, mobility, and/or volume
- 3 = Effective at reducing toxicity, mobility, and/or volume
- 4 = Highly effective at reducing toxicity, mobility, and/or volume
- 5 = Complete reduction of toxicity, mobility, and/or volume

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Cost (relative to other alternatives):
- Ranked by total net present value cost

Sustainability (relative to other alternatives):
- Ranked by sustainability evaluations presented in Section 4

Short-term effectiveness (impact to community, site workers, and environment):

1 = Detrimental impacts during implementation
2 = Significant impacts during implementation
3 = Minimal impacts during implementation
4 = Slight impact during implementation
5 = No impacts during implementation

3 Cost is present in millions of dollars. Three risk levels of cost are presented as E1-04/E1-05/E1-06. A full presentation of alternative costs can be found in Section 4 of the FS.

4 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

5 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness.

6 The sustainability score development is presented in Table 4.3.2-3, evaluated on a scale of 1-25, with sustainability score range definitions below.

Sustainability Criterion Score (relative to other alternatives):

- Ranked by sustainability evaluations presented in Section 4

1-5 = Not sustainable
6-10 = Potentially sustainable
11-15 = Somewhat sustainable
16-20 = Moderately sustainable
21-25 = Highly sustainable

Table 4 – Detailed Comparative Analysis
OU2 – RES Area

Evaluation Criteria	OU2 Soil RES Area Remedial Alternatives			
	Alternative 1 No Action	Alternative 2 On-Site Soil Cover + Institutional Controls	Alternative 3 Soil Excavation + On-Site Consolidation under Soil Cover	Alternative 4 Soil Excavation + Off-Site Disposal
THRESHOLD CRITERIA [1]				
Overall protectiveness of human health and the environment	Fail	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass
PRIMARY BALANCING CRITERIA [2]				
Long-term effectiveness and permanence	NA	Somewhat effective	Highly effective and permanent	Highly effective and permanent
Criteria Score		2	5	5
Reduction of toxicity, mobility, or volume through treatment	NA	Somewhat effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume	Somewhat effective at reducing toxicity, mobility, and/or volume
Criteria Score		2	2	2
Short-term effectiveness	NA	Significant impacts during implementation	Significant impacts during implementation	Significant impacts during implementation
Criteria Score		2	2	2
Implementability	NA	Difficult to implement	Implementable	Implementable
Criteria Score		2	3	3
Cost (relative to other alternatives) [3]	NA	\$107M/ \$128M/ \$128M	\$100M/ \$113M/ \$113M	\$139M/ \$157M/ \$157M
Criteria Score		2	3	1
MODIFYING CRITERIA [4]				
CERCLA Criteria - Alternative Total Score	**NA**	**10**	**15**	**13**
CERCLA Criteria - Alternative Rank	**NA**	**3**	**1**	**2**
OTHER CRITERIA [2,5]				
Sustainability [6]	NA	Somewhat sustainable	Moderately sustainable	Somewhat sustainable

Notes:

1 The Threshold Criteria have been evaluated on a pass/fail basis. An alternative must pass both threshold criteria in order to be consider as a remedial action. Alternatives that fail either threshold criterion are marked with not applicable (NA) for the remaining primary balancing, modifying, and other criteria.

2 The Primary Balancing Criteria have been evaluated on a scale of 1-5. Details on each of the scales for each criterion are listed below:

Long-term effectiveness and permanence:
- 1 = Ineffective and temporary
- 2 = Somewhat effective
- 3 = Effective
- 4 = Highly effective
- 5 = Highly effective and permanent

Implementability:
- 1 = Very difficult to implement
- 2 = Difficult to implement
- 3 = Implementable
- 4 = Readily implementable
- 5 = Easily implementable

Reduction of toxicity, mobility, or volume through treatment:

1 = Does not reduce toxicity, mobility, or volume
2 = Somewhat effective at reducing toxicity, mobility, and/or volume
3 = Effective at reducing toxicity, mobility, and/or volume
4 = Highly effective at reducing toxicity, mobility, and/or volume
5 = Complete reduction of toxicity, mobility, and/or volume

Short-term effectiveness (impact to community, site workers, and environment):

1 = Detrimental impacts during implementation
2 = Significant impacts during implementation
3 = Minimal impacts during implementation
4 = Slight impact during implementation
5 = No impacts during implementation

Cost (relative to other alternatives):

- Ranked by total net present value cost

3 Cost is present in millions of dollars. Three risk levels of cost are presented as E1-04/E1-05/E1-06. A full presentation of alternative costs can be found in Section 4 of the FS.

4 The two Modifying Criteria, State acceptance and community acceptance, will be evaluated following comment on the FS report and the proposed plan, and will be addressed in the ROD.

5 The Other Criterion, sustainability, is not required by CERCLA but it has been included for completeness.

6 The sustainability score development is presented in Table 4.3.5-3, evaluated on a scale of 1-25, with sustainability score range definitions below.

Sustainability Criterion Score (relative to other alternatives):

- Ranked by sustainability evaluations presented in Section 4

1-5 = Not sustainable
6-10 = Potentially sustainable
11-15 = Somewhat sustainable
16-20 = Moderately sustainable
21-25 = Highly sustainable

APPENDIX 1

Brief Narrative Description of All Remedial Alternatives Considered

(Note: Alternatives in **ALL CAPS AND BOLD FONT** were carried through the FS for detailed analysis and are further described in Appendix 2.)

OU1

Carus Plant Area

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.
- Alternative 2 – Institutional Controls (ICs) Only
  Implement land-use restrictions to ensure the land use remains commercial/ industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/ industrial, utility, and construction workers from exposure to contaminants of concern (COCs).
- Alternative 3 - ICs + Property Access Restrictions
  Implement land-use restrictions as described above along with limiting access to the Carus Plant Area through posting of informational signage or fencing, some of which is already in place, to protect commercial/industrial, utility, and construction workers from exposure to COCs and to ensure the land use remains commercial/industrial.
- **ALTERNATIVE 4 - EXCAVATION (WITH OFF-SITE DISPOSAL)**
  Excavate areas of the Carus Plant Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport wastes off site for disposal. Implement land-use restrictions and property access restrictions as described above to ensure land use remains commercial/industrial.
- **ALTERNATIVE 5 - LOW PERMEABILITY COVER**
  Install an engineered low-permeability cover to isolate impacted soil at the Carus Plant Area from commercial/industrial, utility, and construction workers. The cover may consist of a synthetic material, clay, or paving; asphalt paving is a likely option as the majority of the plant site is currently paved. Remove a small quantity of accumulated soil and vegetation from a gravel-paved storage area and consolidate the materials in the on-site slag pile prior to installation of the low-permeability cover over the gravel area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.
- **ALTERNATIVE 6 - SOIL COVER**
  Install an engineered soil cover to isolate impacted soil at the Carus Plant Area from commercial/industrial, utility, and construction workers. Remove a small quantity of accumulated soil and vegetation from a gravel-paved storage area and consolidate the materials in the on-site slag pile prior to installation of asphalt over the gravel area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to

ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

- Alternative 7 - Chemical Stabilization
  Implement chemical stabilization to reduce concentrations of COCs at the Carus Plant Area to levels that do not pose an unacceptable risk to human health for commercial/industrial, utility, and construction workers. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- Alternative 8 – Groundwater Removal & Treatment/Disposal
  Implement groundwater removal and treatment to reduce concentrations of COCs in groundwater to levels that do not pose unacceptable risks to human health. Treated water may be discharged to the publicly-owned treatment works (POTW) or directly to the Little Vermilion River (LVR). Implement land- and groundwater-use restrictions and property access restrictions.

- Alternative 9 - Groundwater Removal & Treatment/Recirculation
  Implement groundwater removal and treatment to reduce concentrations of COCs in groundwater to levels that do not pose unacceptable risks to human health. Treated water would be recirculated within the targeted treatment area to enhance flushing of impacted groundwater. Implement land- and groundwater-use restrictions and property access restrictions.

Slag Pile Area (including Slope Stability)

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.

- Alternative 2 - ICs Only
  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs.

- Alternative 3 - ICs + Property Access Restrictions
  Implement land-use restrictions as described above along with limiting access to the Slag Pile Area through fencing to protect commercial/industrial, utility, and construction workers from exposure to COCs and to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 4 - EXCAVATION (WITH OFF-SITE DISPOSAL)**
  Excavate areas at the Slag Pile Area with soil concentrations above acceptable commercial/industrial human health risk levels (this assumes that all slag would be removed). Transport excavated materials off site for disposal. Backfill the excavated areas. Implement land-use restrictions and property access restrictions as described above to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 5 - LOW PERMEABILITY COVER**
  Install an engineered low-permeability cover to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. The cover may consist of a synthetic material or clay. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and

construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

- **ALTERNATIVE 6 - SOIL COVER**
  Install an engineered soil cover to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/ industrial, and to protect the constructed remedy components.

- Alternative 7 - Chemical Stabilization
  Implement chemical stabilization at the Slag Pile Area to reduce concentrations of COCs to levels that do not pose an unacceptable risk to human health for commercial/industrial, utility, and construction workers. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- Alternative 8 - Phytoremediation
  Implement phytoremediation at the Slag Pile Area to reduce concentrations of COCs to levels that do not pose an unacceptable risk to human health for commercial/industrial, utility, and construction workers. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- Alternative 9 - Groundwater Removal & Treatment
  - Implement groundwater removal and treatment to reduce concentrations of COCs in groundwater to levels that do not pose unacceptable risks to human health. Treated water may be discharged to the POTW or directly to the LVR. Implement land- and groundwater-use restrictions and property access restrictions.

- Alternative 10 - Groundwater Removal & Treatment/Recirculation
  Implement groundwater removal and treatment to reduce concentrations of COCs in groundwater to levels that do not pose unacceptable risks to human health. Treated water would be recirculated within the targeted treatment area to enhance flushing of impacted groundwater. Implement land- and groundwater-use restrictions and property access restrictions.

- Alternative 11 - Geochemical Fixation
  Implement groundwater treatment through geochemical fixation to reduce concentrations of COCs in groundwater to levels that do not pose unacceptable risks to human health. Implement land- and groundwater-use restrictions and property access restrictions.

- **ALTERNATIVE 12 - EXCAVATION (WITH ON-SITE CONSOLIDATION ON OU2)**
  This alternative is the same as Alternative 4 except that the excavated materials from the Slag Pile Area would be taken to OU2 for consolidation in an on-site consolidation area instead of being transported off site for disposal.

The following alternatives would physically stabilize the slope of the slag pile and would reduce surface runoff and slope erosion. These alternatives may be implemented in conjunction with Alternatives 5 or 6 above.

- Alternative 13 - Sloping and Benching + Best Management Practices (BMPs)
  Remove existing vegetation from the slag pile. Excavate, slope, and bench the slag pile along the LVR, and install a 2-foot-thick engineered soil cover. Implement BMPs, including seeding for the soil cover. Implement additional BMPs such as straw wattles, graded bench with check dams and rip-rapped down chutes, and top of slope surface runoff control berms and graded surface swales.

- **ALTERNATIVE 14 - SLOPING AND BENCHING + REVETMENTS AT THE TOE OF THE SLOPE + BMPS**
  Remove existing vegetation from the slag pile. Excavate, slope, and bench the slag pile along the LVR, and install a 2-foot-thick engineered soil cover. Install revetments at the toe of the slope for erosion protection along the river. Implement BMPs, including seeding for the soil cover. Implement additional BMPs such as straw wattles, graded bench with check dams and rip-rapped down chutes, and top of slope surface runoff control berms and graded surface swales.

- **ALTERNATIVE 15 – SLOPING AND BENCHING + PLANTINGS + REVETMENTS AT THE TOE OF THE SLOPE + BMPS**
  This alternative is the same as Alternative 14 except for the addition of high-density tree planting to further stabilize the slope of the slag pile.

OU2

Main Industrial Area

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.

- **ALTERNATIVE 2 - SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER**
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

- **ALTERNATIVE 3 - EX-SITU CHEMICAL STABILIZATION**
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use chemical stabilization to treat the excavated materials at an on-site treatment location within the Main Industrial Area. This would reduce the mobility and bioavailability of the COCs and decrease risks to acceptable levels. Use the treated, stabilized soil as backfill material at the original excavation location. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 4 - SOIL EXCAVATION + EX-SITU TREATMENT BY SOIL WASHING**
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use soil washing to treat the excavated materials at an on-site soil-washing treatment location within the Main Industrial Area, to reduce concentrations of COCs to acceptable levels. Use the treated soil as backfill material at the original excavation location. Transport and dispose of washing wastewater and dewatered sludge at an off-site facility. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 5 - SOIL EXCAVATION + OFF-SITE DISPOSAL**
  Excavate areas at the Main Industrial Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport the excavated materials off site for disposal. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

<u>North Area</u>

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.

- **ALTERNATIVE 2 - ICS ONLY**
  Implement land-use restrictions to ensure the land use remains commercial/ industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/ industrial, utility, and construction workers from exposure to COCs.

- **ALTERNATIVE 3 - PHYTOREMEDIATION**
  Treat soil contaminants at the North Area through phytoremediation. Install appropriate plants that specialize in uptake of the various COCs. Harvest plants up to two times per season (including at the end of each growing season) and transport off site for disposal. Implement land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

- **ALTERNATIVE 4 - SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER**
  Excavate areas at the North Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 5 - SOIL EXCAVATION + OFF-SITE DISPOSAL**
  This alternative is the same as Alternative 4 above except that the excavated materials from the North Area would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

Building 100 Area

- **ALTERNATIVE 1 - No Action**
  No action will be taken to mitigate risk.
- **ALTERNATIVE 2 - ICS ONLY**
  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs.
- **ALTERNATIVE 3 - SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER**
  Excavate areas at the Building 100 Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.
- **ALTERNATIVE 4 - SOIL EXCAVATION + OFF-SITE DISPOSAL**
  This alternative is the same as Alternative 3 above except that the excavated materials from the Building 100 Area would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

Rolling Mill Area

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.
- **ALTERNATIVE 2 - ICS ONLY**
  Implement land-use restrictions to ensure the land use remains commercial/industrial. Require any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect commercial/industrial, utility, and construction workers from exposure to COCs.
- **ALTERNATIVE 3 - SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER**
  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Consolidate excavated materials in an on-site consolidation area at the Main Industrial Area. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.
- **ALTERNATIVE 4 - SOIL EXCAVATION + *EX-SITU* TREATMENT BY SOIL WASHING**
  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Use soil washing to treat the excavated materials at an on-site soil-washing treatment location within the Main Industrial Area, to reduce concentrations of COCs to acceptable levels. Use the treated soil as backfill material at the original excavation location. Transport and dispose of washing wastewater and dewatered sludge at an off-site facility.

Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

- **ALTERNATIVE 5 - SOIL EXCAVATION + OFF-SITE DISPOSAL**
  Excavate areas at the Rolling Mill Area with soil concentrations above acceptable commercial/industrial human health risk levels. Transport the excavated materials off site for disposal. Implement land-use restrictions and property access restrictions to ensure the land use remains commercial/industrial.

Off-Site Residential Area

- **ALTERNATIVE 1 - NO ACTION**
  No action will be taken to mitigate risk.

- **ALTERNATIVE 2 - ON-SITE SOIL COVER**
  Cover contaminated soil at impacted properties in the Off-Site Residential Area with a 1-foot-thick soil cover. Implement land-use restrictions at impacted properties to exclude gardens (except for raised-bed gardens using imported clean soil) and to protect the constructed remedy components.

- **ALTERNATIVE 3 - SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER**
  Excavate contaminated soil at impacted properties in the Off-Site Residential Area to a maximum depth of 24 inches. Consolidate excavated materials in an on-site consolidation area at the Main Industrial Area. If contamination remains in place deeper than 24 inches, install a visual barrier on top of the underlying contamination prior to backfilling with clean soil, and implement land-use restrictions as appropriate.

- **ALTERNATIVE 4 - SOIL EXCAVATION + OFF-SITE DISPOSAL**
  This alternative is the same as Alternative 3 above except that the excavated materials from the Off-Site Residential Area would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

APPENDIX 2
Detailed Description of Alternatives carried through the FS

<u>OU1: Carus Plant Area</u>

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual Operation and Maintenance (O&M) Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 4 – EXCAVATION (WITH OFF-SITE DISPOSAL)

Estimated Capital Cost: $5,621,150
Estimated Annual O&M Cost: $
Estimated Present Worth Cost: $ 5,950,000
Estimated Construction Timeframe: 3-4 months

Soil would be excavated up to 4 feet in areas of the Carus Plant Area where soil concentrations are found above acceptable commercial/industrial human health risk levels. It is estimated that 24,200 cubic yards (cy) would be transported off site for disposal into an approved facility. The excavated areas would then be backfilled to an 18-inch thickness with approximately 18,000 cy of clean soil. The Gravel Paved Storage Area would be covered with a half-foot of clay. Asphalt would be placed over the rest of the excavated areas. Land use restrictions would be established, requiring that the land use of the Carus Plant Area is maintained as commercial/industrial. Additional restrictions would require maintenance of the existing fencing and signage around the Carus Plant Area, and identification of the potential risks and hazards that exist. An Institutional Controls Monitoring Plan (ICMP) would be prepared for the site that details the land use restrictions. The ICMP would include a checklist of elements to be assessed during regularly scheduled on-site inspections. On-site inspections would review the fencing to ensure its integrity, verify warning signs are in place and intact, and ensure that any disturbance or removal of structures or existing pavement adheres to institutional controls (ICs). For cost estimating purposes, it is assumed that the IC inspections would be performed once per year for 30 years.

ALTERNATIVE 5 – LOW PERMEABILITY COVER

Estimated Capital Cost: $1,184,300
Estimated Annual O&M Cost: $
Estimated Present Worth Cost: $ 1,530,000
Estimated Construction Timeframe: 1 month

A low permeability cover will be placed in areas where the existing asphalt or concrete cover has been damaged or new cover is necessary to reduce potential direct exposure risks. The low permeability cover for Alternative 5 will be a non-porous pavement cover, which will be placed after subgrade excavation to acquire proper grade. As part of Alternative 5, the Gravel Paved

Storage Area will have the accumulated soil and vegetation removed and disposed on site with the slag at the Slag Pile Area. Following removal of the accumulated material, the base, side slopes, and top edges of the storage area will be lined with a minimum 1-foot-thick low permeability clay cover. No geotextile fabric will be placed between the clay and native material. The Gravel-Paved Storage Area cover will be covered by asphalt cover. The total asphalt area is approximately 4,100 square yards and the total compacted clay volume is approximately 1,400 cy. Land-use restrictions and property access restrictions will be implemented to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

ALTERNATIVE 6 – SOIL COVER

Estimated Capital Cost: $1,274,300
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $1,620,000
Estimated Construction Timeframe: 1 month

This alternative will include excavating approximately 4,600 cy of contaminated soil across the plant, and then the installation of an engineered soil cover to isolate impacted soil at the Carus Plant Area from commercial/industrial, utility, and construction workers. Approximately 3,450 cy of engineered soil will be placed across the Carus Plant Area. The surface area soil cover for Alternative 6 will be 18 inches of clean compacted fill with an additional 6 inches of gravel placed after subgrade excavation to acquire proper grade. A gravel cover instead of a topsoil cover is required because the majority of the excavated and replaced materials are in areas that will have vehicular travel. In the Gravel Paved Storage Area a small quantity of accumulated soil and vegetation will be excavated and consolidated in the on-site slag pile prior to installation of asphalt over the gravel area. Land-use restrictions and property access restrictions will be implemented to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components.

OU1: Slag Pile Area (including Slope Stability)

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 4 – EXCAVATION (WITH OFF-SITE DISPOSAL)

Estimated Capital Cost: $213,576,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $214,069,000
Estimated Construction Timeframe: 22 months

This alternative would include excavating roughly 1,200,000 cy of slag with concentrations above acceptable commercial/industrial human health risk levels and disposing of this material off site. Excavation would primarily be based on the visual extent of slag. Removal of all the soil/solid matrix material would also require replacement with compacted clean fill to an elevation above the river Probable Maximum Flood level, assumed to be approximately at elevation 475 feet above mean sea level, or at least 15 feet above river bottom. The volume of backfill is estimated at 615,000 cy. Land use restrictions and property access restrictions would be needed to ensure the land use remains commercial industrial. An ICMP would be created and would include a checklist of elements to be assessed during regularly scheduled on-site inspections. On-site inspections would review the fencing to ensure its integrity, verify warning signs are in place and intact, and ensure that any disturbance or removal of existing structures or pavement adheres to ICs. For cost estimating purposes, it is assumed that the IC inspections would be performed once per year for 30 years.

ALTERNATIVE 5 – LOW PERMEABILITY COVER

Estimated Capital Cost: $6,756,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $7,309,000
Estimated Construction Timeframe: 9 months

This alternative would include placing an engineered low-permeability cover to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. It is estimated that approximately 50,000 cy of material, at a thickness of 18 inches, will be placed under 6 inches of clayey topsoil. This alternative does not include the cut slope with benching and toe revetment components or the holding pond cut slope and reconstruction components. Although this alternative, without stabilization components, may not be practicable for the long term, it was included for purposes of comparison. This alternative also includes land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. Periodic site reviews would be performed as part of this alternative to evaluate how the site conditions may have changed over time.

ALTERNATIVE 6 – SOIL COVER

Estimated Capital Cost: $6,534,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $7,087,000
Estimated Construction Timeframe: 9 months

This alternative would involve the covering of exposed soils to isolate impacted soil at the Slag Pile Area from commercial/industrial, utility, and construction workers. It is estimated that approximately 50,000 cy of engineered soil, at a thickness of 18 inches, would be placed on the slag pile. This alternative does not include the cut slope with benching and toe revetment components or the holding pond cut slope and reconstruction components. Although this alternative, without stabilization components, may not be practicable for the long term, it was included for purposes of comparison. This alternative also includes land-use restrictions and property access restrictions to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. Periodic site reviews would be performed as part of this alternative to evaluate how the site conditions may have changed over time. Regular cover maintenance would be required to ensure the long-term effectiveness of the protection.

ALTERNATIVE 12 – EXCAVATION (WITH ON-SITE CONSOLIDATION ON OU2)

Estimated Capital Cost: $101,083,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $101,636,000
Estimated Construction Timeframe: 22 months

This alternative would include excavating roughly 1,200,000 cy of slag with concentrations above acceptable commercial/industrial human health risk levels and placing this material in an on-site consolidation area on OU2. Excavation would primarily be based on the visual extent of slag. Removal of all the soil/solid matrix material would also require replacement with compacted clean fill to an elevation above the river Probable Maximum Flood level, assumed to be approximately at elevation 475 feet above mean sea level, or at least 15 feet above river bottom. The volume of backfill is estimated at 615,000 cy. Land use restrictions and property access restrictions would be needed to ensure the land use remains commercial industrial. An ICMP would be created and would include a checklist of elements to be assessed during regularly scheduled on-site inspections. On-site inspections would review the fencing to ensure its integrity, verify warning signs are in place and intact, and ensure that any disturbance or removal of existing structures or pavement adheres to ICs. For cost estimating purposes, it is assumed that the IC inspections would be performed once per year for 30 years.

The following alternatives would physically stabilize the slope of the slag pile and would reduce surface runoff and slope erosion. These alternatives may be implemented in conjunction with Alternatives 5 or 6 above.

ALTERNATIVE 14 – SLOPING AND BENCHING + REVETMENTS[1] AT THE TOE OF THE SLOPE + BEST MANAGEMENT PRACTICES (BMPs)

Estimated Capital Cost: $17,479,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $17,986,000
Estimated Construction Timeframe: 10 months

This alternative includes removal of the existing Slag Pile Area vegetation, and excavation, sloping, and benching of the slag pile along the Little Vermilion River (LVR). At a maximum, the excavation, sloping, and benching will result in a 1:2 vertical-to-horizontal slope with 5-foot wide benches at approximately 32-foot elevation intervals. A minimum 2-foot thick cover consisting of 6 inches of clayey topsoil over a minimum 18 inches of compacted soil or 18 inches of compacted low permeability clay will be placed in a minimum of two compacted layers. The benches on the slope will be graded, draining surface flow to down-chutes to the LVR. The toe of slope along the river may include, if necessary, an 8-foot wide retained bench,

[1] Revetments are structures that would provide erosion control armoring at the toe of the slope of the slag pile.

which is 3 to 5 feet above the low river level. The toe of slope and top of bench, to an approximate elevation of 475 feet above mean sea level, would be protected with 18 inches of riprap over geotextile for river erosion protection. An exception to the 1:2 vertical-to-horizontal slope is the slope along the LVR near the holding pond located at the south end of OU1; the excavation and sloping along the LVR near the holding pond would be at a minimum 1:2.5 (vertical to horizontal). The 1:2.5 slope would also be used as the exterior slope for the east side (river side) berm of a modified and newly-constructed holding pond and NPDES discharge point. The east side berm or top of the west side hill may also function as a haul route for delivery of soils and materials for OU1 and OU2 remedial action work. In that case, revised grading along the pond would be needed. BMPs will include soil cover seeding selected for growth over the soil-covered slag pile. Additional BMPs, both temporary and permanent, such as straw wattles, graded bench with check dams and rip-rapped down-chutes, and top of slope surface runoff control berms and graded surface swales would also be provided.

ALTERNTIVE 15 – SLOPING AND BENCHING + PLANTINGS + REVETMENTS AT THE TOE OF THE SLOPE + BMPs

Estimated Capital Cost: $17,617,000
Estimated Annual O&M Cost:
Estimated Present Worth Cost: $18,124,000
Estimated Construction Timeframe: 10 months

This alternative includes remedial action components to prevent stormwater influx and slag erosion to the LVR. The alternative is identical to Alternative 14, as described above, with the addition of high density tree planting to further stabilize the slope. The two-foot cover would be sufficient to support the anticipated tree root depth.

<u>OU2: Main Industrial Area</u>

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 2 – SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER

Estimated Capital Cost: $33,400,900
Estimated Annual O&M Cost: $34560 [Years 1-5] $24,100 [Years 6-30
Estimated Present Worth Cost: $33,600,000
Estimated Construction Timeframe: 26 months

Prior to excavation, demolition of subsurface structures and obstructions will need to be completed. Demolition debris, including concrete foundation, steel piping, etc., will need to be separated and classified for either on-site consolidation or off-site disposal. In addition, soil in the proposed on-site consolidation area will not be excavated, as the consolidation area will be constructed at the existing grade. The excavated material will be stockpiled in the Main Industrial Area and transferred into the consolidation area on a daily basis, once the consolidation area is fully prepared and ready to accept excavated soil. No soil will be transported off site for disposal as part of this alternative. Roughly 400,000 cy of contaminated material from the Main Industrial Area with concentrations above acceptable commercial/ industrial human health risk levels would be excavated and placed into the consolidation area.

Excavated soil will be transported from each of the contributing areas and will be placed into a single consolidation area in the Main Industrial Area. It is anticipated that almost 950,000 cy of material will be placed into the consolidation area from the remedial action work at the site. When the contaminated soil has been consolidated, it will be covered with a soil cover. The FS assumed that the soil cover will consist of 2 feet of compacted clay with a hydraulic conductivity of 1E-07 cm/s, followed by 1 foot of topsoil, which will restrict direct contact with contaminated soil. A permeable geotextile liner will be placed on top of the contaminated soil in order to demarcate the clean cover from the contaminated soil. Erosion mats will be installed along the top and slopes of the consolidation area to protect and stabilize the cover. A stormwater drainage system will be installed on each slope of the consolidation area and around the perimeter to drain water off of the consolidation area and into the existing LaSalle stormwater system. The stormwater drainage system will consist of 6-foot-wide swales, lined with erosion control mats and filled with a combination of 1 foot of stone bedding and 1 foot of riprap, and will lead to a stormwater control structure. Stormwater will then be transported approximately 1,000 feet to the existing LaSalle stormwater system and the LaSalle publicly owned treatment works. The consolidation area will then be seeded to minimize soil erosion and maintain cover stability. This area will be developed with a maximum side slope of 1:3 (vertical: horizontal) to minimize slope failure and possible soil erosion. Land-use restrictions and property access restrictions will be implemented to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. An ICMP will be prepared for the Main Industrial Area that details the land use restrictions to be incorporated. The ICMP will include a checklist of elements to be assessed during regularly scheduled on-site inspections. Elements of the on-site inspections will include review of the fencing to confirm its integrity, verify that warning signs are in place and intact, that no structures or existing pavement have been disturbed or removed, and that the soil cover is intact and remains protective. For cost-estimating purposes, it is assumed that the IC site inspections will be performed once per year for 30 years.

ALTERNATIVE 3 – EX-SITU CHEMICAL STABILIZATION

Estimated Capital Cost: $72,000,500
Estimated Annual O&M Cost: $60,000 first year; none after first year
Estimated Present Worth Cost: $72,586,000
Estimated Construction Timeframe: 33 months

This alternative includes remedial action components to stabilize contaminant concentrations in the soil that exceed acceptable commercial/industrial human health risk levels, and consists of four components: (1) excavation of contaminated soil and transportation to an on-site mixing basin or pugmill; (2) mixing chemical stabilizer with contaminated soil using clamshell excavators or pugmill; (3) transportation of stabilized soil back to original location for use as backfill; and (4) compaction and restoration of the site ground surface. Prior to stabilization, demolition of subsurface structures and obstructions will need to be completed. An excavator may be used to excavate the soil to a desired depth and load on-site haul trucks for transportation of contaminated soil to the desired mixing location. Approximately 400,000 cy of material would be treated by this alternative. Demolition debris, including concrete foundation, steel piping, etc., will need to be separated for off-site disposal. O&M will be primarily short term (less than 6 months) and consists of maintenance of the restored areas until vegetation is established. Land-use restrictions and property access restrictions will be implemented to ensure the land use remains commercial/industrial.

ALTERNATIVE 4 – SOIL EXCAVATION + EX-SITU TREATMENT BY SOIL WASHING

Estimated Capital Cost: $181,948,500
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $182,001,000
Estimated Construction Timeframe: 70 months

This alternative includes remedial action components to treat contaminant concentrations in the soil that exceed acceptable commercial/industrial human health risk levels, and consists of six components: (1) excavation of contaminated soil; (2) transportation of excavated soil to the on-site soil-washing treatment location within the Main Industrial Area; (3) soil washing treatment, rinsing, and dewatering; (4) transportation of washed soil back to the original excavation location for use as backfill; (5) soil compaction and site ground surface restoration; and (6) transportation and disposal of washing wastewater and dewatered sludge. Under this alternative, the treated and dewatered soil will be transported back to the original excavation area for backfill, compaction, and surface restoration. Approximately 400,000 cy of contaminated material will be treated by this alternative. Demolition debris, including concrete foundation, steel piping, etc., will need to be separated for off-site disposal. O&M will be primarily short term (less than 6 months) and consists of maintenance of the restored areas until vegetation is established. Land-use restrictions and property access restrictions will be implemented to ensure the land use remains commercial/industrial.

ALTERNATIVE 5 – SOIL EXCAVATION + OFF-SITE DISPOSAL

Estimated Capital Cost: $124,489,500
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $124,542,000
Estimated Construction Timeframe: 42 months

This alternative is relatively the same as Alternative 2 except that, under this alternative, the 400,000 cy of excavated soil that exceeds acceptable commercial/industrial human health risk levels will be transported off site for disposal instead of being placed within the on-site consolidation area. Land-use restrictions and property access restrictions will be implemented to ensure the land use remains commercial/industrial. The excavated material will be temporarily stockpiled on OU2 and continuously loaded out to the off-site disposal facility. The soil stockpiles will be sampled in accordance with the off-site disposal facility requirements. Some soil from the Main Industrial Area will likely require disposal as a hazardous waste and/or as soil containing asbestos. After excavation, clean soil will be added to the excavation areas and compacted, and the surface will be restored.

<u>OU 2 - North Area</u>

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 2 – ICS ONLY

Estimated Capital Cost: $144,000
Estimated Annual O&M Cost: $6,970
Estimated Present Worth Cost: $283,000
Estimated Construction Timeframe: 1 month (no construction)

This alternative does not include remedial action components to contain or reduce contaminant concentrations in the soil. Instead, it controls potential risks and hazards from exposure to contaminated soil solely by implementing ICs. Annual site inspections and CERCLA mandated five-year reviews will be performed as part of this alternative to evaluate how site conditions may change over time. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 3 - PHYTOREMEDIATION

Estimated Capital Cost: $12,013,000
Estimated Annual O&M Cost: $19,320 [Years 1-5] $13,270 [Years 6-30]
Estimated Present Worth Cost: $12,152,000
Estimated Construction Timeframe: 1 month

This alternative would include the installation of plants in areas with contamination in shallow soils. For the purposes of the FS, the plants most likely to be used are the Chinese Brake Fern (CBF), *Pteris vittata*, which specializes in arsenic uptake, and Indian Mustard, *Brassica juncea*, which specializes in lead uptake. A third plant to address polynuclear aromatic hydrocarbons (PAHs) in soil may need to be selected during the remedial design (RD) if neither CBF nor Indian Mustard affects the PAHs during the bench and pilot tests. The actual plants to be used will be determined during the RD. The CBF and Indian Mustard have been used in costing of the alternative. The plants will require harvesting at the end of the growing season, with the harvested plants transported off site for disposal. The harvested plants may be classified as a non-hazardous waste for disposal. The proposed application of phytotechnology will address contamination using phytoaccumulation to remove contaminants from the soil and concentrate them in the plant, and to a lesser degree, phytostabilization to immobilize the contaminants and stabilize the soil matrix. Land-use restrictions and property access restrictions will be implemented to protect commercial/industrial, utility, and construction workers, to ensure the land use remains commercial/industrial, and to protect the constructed remedy components. The ICs will ensure that deeper contamination remains undisturbed and that the time needed to establish the plants is provided, and will reduce potential risks and hazards from exposure to contamination. Periodic site reviews would be performed as part of this alternative to evaluate how the site conditions may have changed over time.

ALTERNATIVE 4 – SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SIOL COVER

Estimated Capital Cost: $14,900,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $14,900,000
Estimated Construction Timeframe: 7 months

For this alternative, approximately 170,000 cy of soil with concentrations above acceptable commercial/industrial human health risk levels will be excavated from the North Area and placed in the on-site consolidation area. The excavated material will be transferred to the consolidation area in the Main Industrial Area on a continuous basis. No soil will be transported off site for disposal as part of this alternative. Excavated areas will be backfilled and plantings will be established. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 5 – SOIL EXCAVATION + OFF-SITE DISPOSAL

Estimated Capital Cost: $34,800,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $34,800,000
Estimated Construction Timeframe: 7 months

This alternative is the same as Alternative 4 except that the 170,000 cy of excavated materials from the North Area that exceeds acceptable commercial/industrial human health risk levels would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

OU 2 - Building 100 Area

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 2 – ICS ONLY

Estimated Capital Cost: $292,000
Estimated Annual O&M Cost: $30,930
Estimated Present Worth Cost: $431,000
Estimated Construction Timeframe: 1 month (no construction)

This alternative does not include remedial action components to contain or reduce contaminant concentrations in the soil. Instead, it controls potential risks and hazards from exposure to contaminated soil solely by implementing ICs. Annual site inspections and CERCLA mandated five-year reviews will be performed as part of this alternative to evaluate how site conditions may change over time. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 3 – SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER

Estimated Capital Cost: $3,200,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $3,200,000
Estimated Construction Timeframe: 4 months

For this alternative, approximately 34,000 cy of soil with concentrations above acceptable commercial/industrial human health risk levels will be excavated from the Building 100 Area and placed in the on-site consolidation area. The excavated material will be transferred to the consolidation area in the Main Industrial Area on a continuous basis. No soil will be transported off site for disposal as part of this alternative. Excavated areas will be backfilled and plantings will be established. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 4 – SOIL EXCAVATION + OFF-SITE DISPOSAL

Estimated Capital Cost: $9,200,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $9,200,000
Estimated Construction Timeframe: 5 months

This alternative is the same as Alternative 3 except that the 34,000 cy of excavated materials from the Building 100 Area that exceeds acceptable commercial/industrial human health risk levels would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

OU2 - Rolling Mill Area

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 2 – ICS ONLY

Estimated Capital Cost: $330,000
Estimated Annual O&M Cost: $6,970
Estimated Present Worth Cost: $469,000
Estimated Construction Timeframe: 1 month (no construction)

This alternative does not include remedial action components to contain or reduce contaminant concentrations in the soil. Instead, it controls potential risks and hazards from exposure to contaminated soil solely by implementing ICs. Annual site inspections and CERCLA mandated five-year reviews will be performed as part of this alternative to evaluate how site conditions may change over time. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 3 – SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER

Estimated Capital Cost: $3,600,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $3,600,000
Estimated Construction Timeframe: 3 months

For this alternative, approximately 24,000 cy of soil with concentrations above acceptable commercial/industrial human health risk levels will be excavated from the Rolling Mill Area and placed within the on-site consolidation area. The excavated material will be transferred to the consolidation area in the Main Industrial Area on a continuous basis. No soil will be transported off site for disposal as part of this alternative. Excavated areas will be backfilled and plantings will be established. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of denoting the risks and hazards for the area.

ALTERNATIVE 4 – SOIL EXCAVATION + EX-SITU TREATMENT BY SOIL WASHING

Estimated Capital Cost: $10,074,800
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $10,127,000
Estimated Construction Timeframe: 4 months

This alternative consists of six components: (1) excavating contaminated soil with concentrations above acceptable commercial/industrial human health risk levels; (2) transporting excavated soil from the Rolling Mill Area to an on-site soil-washing treatment location established within the

Main Industrial Area; (3) soil-washing treatment, rinsing, and dewatering; (4) transporting washed and dewatered soil back to its original excavation location in the Rolling Mill Area for use as backfill; (5) compacting the soil and restoring the site ground surface; and (6) transporting and disposing of washing wastewater and dewatered sludge off site. It is assumed that a soil-washing system will be built onsite, in the Main Industrial Area. Roughly 24,000 cy of soil will be excavated from the Rolling Mill Area and transported to the Main Industrial Area for treatment and dewatering, then transported back to the original excavation location for use as backfill. This alternative includes land-use restrictions to ensure the land use remains commercial/industrial, along with other restrictions that would require installation and maintenance of signage denoting the risks and hazards for the area.

ALTERNATIVE 5 – SOIL EXCAVATION + OFF-SITE DISPOSAL

Estimated Capital Cost: $7,300,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $7,300,000
Estimated Construction Timeframe: 3 months

This alternative is the same as Alternative 3 except that the 24,000 cy of excavated materials from the Rolling Mill Area with concentrations above acceptable commercial/industrial human health risk levels would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.

OU2 - Off-Site Residential Area

ALTERNATIVE 1 – NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

No action will be taken to mitigate risk.

ALTERNATIVE 2 – ON-SITE SOIL COVER

Estimated Capital Cost: $104,894,000
Estimated Annual O&M Cost: $1,678,800 [Years 1-5] $1,018,000 [Years 6-30]
Estimated Present Worth Cost: $127,590,000
Estimated Construction Timeframe: 148 months

This alternative includes remedial action components to minimize direct contact with contaminants in the soil by placing a cover over contaminated soil. A visible barrier, such as orange construction fencing or landscaping fabric, is placed over the contaminated soil and beneath the soil cover. Residual contamination will be left in place and covered with a 12-inch-thick soil cover. ICs will be put in place to limit future land uses (to exclude gardens) and to protect the integrity of the soil cover. After installation of the soil cover, each yard will be restored as close as practicable to its pre-remedial condition.

ALTERNATIVE 3 – SOIL EXCAVATION + ON-SITE CONSOLIDATION UNDER A SOIL COVER

Estimated Capital Cost: $112,147,700
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $112,925,000
Estimated Construction Timeframe: 177 months

This alternative includes excavating contaminated soils and transporting the soils to the Main Industrial Area for consolidation in the on-site consolidation area under a soil cover. In order to estimate the percentage of properties that are likely to require cleanup, the residential area was divided into four zones, based on the density of properties sampled during the remedial investigation (RI) and distance from the on-site areas of OU2. Based on sampling conducted during the RI, a total of approximately 3,000 properties are estimated to require cleanup. No soil will be transported off site for disposal as part of this alternative. For cost-estimating purposes, the maximum excavation depth at the off-site residential properties is estimated to be 24 inches. However, the final excavation depth may be less, based on pre-design sample results. It is estimated that close to 300,000 cy of material will be excavated from the residential area. The excavated material will be directly loaded into roll-off containers and transported to the Main Industrial Area for temporary stockpiling until the consolidation area is ready. If contamination remains in place deeper than 24 inches, a visual barrier, such as orange construction fence or landscape fabric, will be placed on top of the contaminated soil and beneath the clean backfill soil. The need for ICs will be evaluated on a property-by-property basis, depending on whether any contaminated soil remains in place at depth.

ALTERNATIVE 4 – SOIL EXCAVATION + OFF-SITE DISPOSAL

Estimated Capital Cost: $156,248,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $157,025,000
Estimated Construction Timeframe: 176 months

This alternative is the same as Alternative 3 except that the 300,000 cy of excavated materials from the residential area would be transported off site for disposal instead of being consolidated in the on-site consolidation area at the Main Industrial Area.